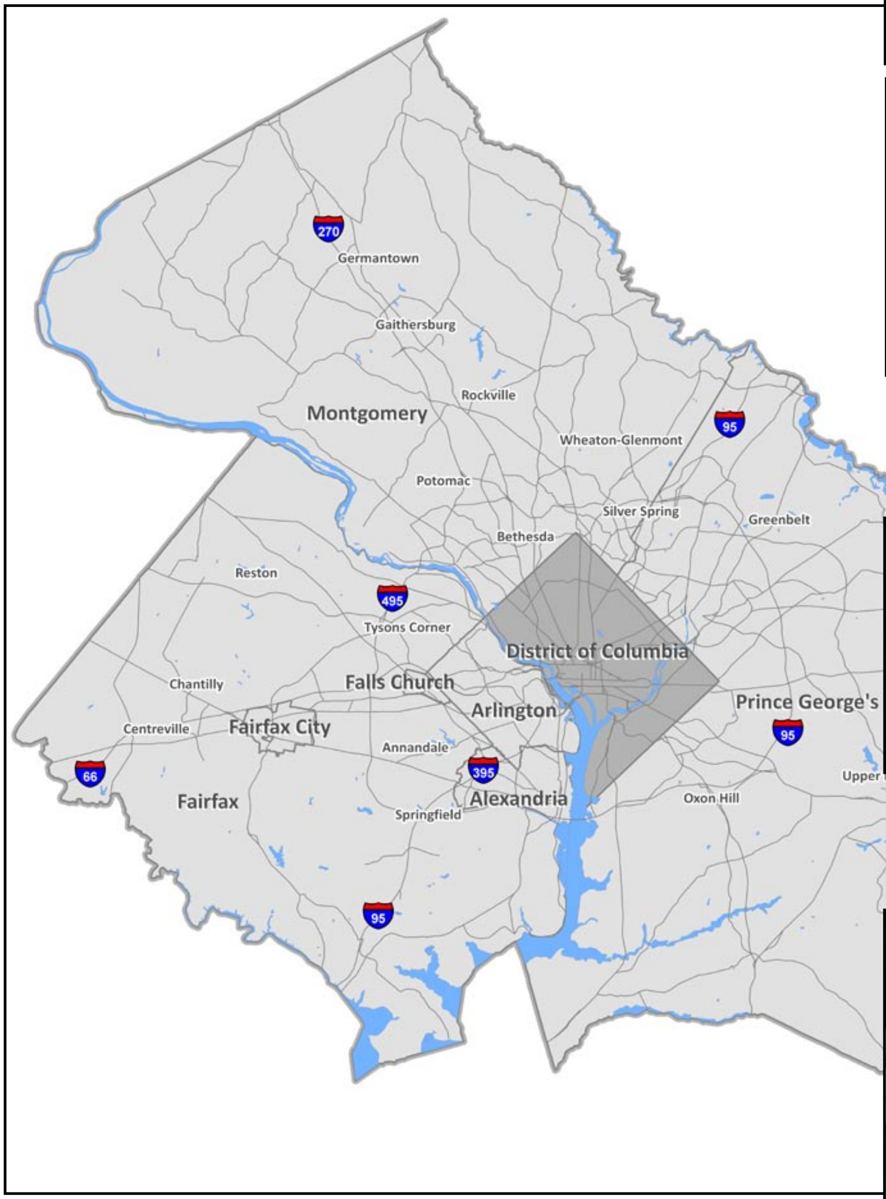
# Accessible Pathways Analysis for the Washington Metropolitan Area Transit Authority's MetroAccess Customers

**FINAL REPORT** **NOVEMBER 2008**



Prepared for: Washington Metropolitan Area Transit Authority and
Metropolitan Washington Council of Governments

# KFH GROUP, INC.

# ACCESSIBLE PATHWAYS ANALYSIS FOR THE WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY'S METROACCESS CUSTOMERS

*Final Report*

November, 2008

In association with:
Cambridge Systematics, Inc.

Prepared for the:

Metropolitan Washington Council of Governments
and the
Washington Metropolitan Area Transit Authority

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# Section 1

# Introduction

## BACKGROUND

MetroAccess is the Americans with Disabilities Act (ADA) complementary paratransit service for the Washington Metropolitan Area Transit Authority (WMATA) region, serving riders with disabilities who are functionally unable to use the fixed-route system. The system, operated by a contract broker with four dedicated providers (including the broker) and five non-dedicated service providers, schedules close to 6,000 passenger trips and provides over 100,000 completed trips in an average month. It is among the largest ADA paratransit systems in the country.

There are currently over 16,000 persons registered as eligible for MetroAccess. Eligibility for the service is determined through a process that involves both a written application as well as an in-person functional assessment. These assessments are conducted by licensed physical and occupational therapists under contract to WMATA, and assess whether applicants are functionally able to use fixed-route service.

The large majority of applicants determined eligible are given full eligibility, that is, the process has determined that they require MetroAccess for all their trips for the three-year certification period, after which re-certification is required. Applicants may also be given temporary eligibility for disabling conditions that are of short-term duration, for example, for three months or six months.

The ADA also allows certification to be given on a conditional or trip-by-trip basis, so that an applicant may be eligible for ADA paratransit only for those specific trips for which fixed-route cannot be used. MetroAccess has given conditional eligibility for a small proportion of applicants.

Conditional eligibility could involve, for example, a person who uses a wheelchair and travels independently throughout the community, but needs ADA paratransit service only during times when there is snow on the ground, impeding his travel. In such case, that person could be given conditional eligibility so that they were eligible only during the winter months. Or a person with a disability may be able to use fixed-route to travel to and from his work site. However, for non-routine trips, such as to a medical appointment or to a friend's house, there may be no appropriate accessible fixed-route transit service, so that person will need ADA paratransit for those non-work trips.

But, similar to most ADA paratransit systems, WMATA has not fully operationalized conditional eligibility, particularly trip-by-trip eligibility, given that it requires a significant commitment to understanding the pedestrian environment that riders must negotiate to use fixed-route transit and to documenting that environment. This is labor and data-intensive, and most transit agencies have not yet made that commitment. There are at least two notable exceptions:

- ACCESS in Pittsburgh has been using trip-by-trip eligibility for a number of years. This agency fully implements trip-by-trip eligibility. During the eligibility process, if an applicant is determined functionally able to use fixed-route at least some of the time, the agency sends a trained staff member to assess the path of travel that the person would need to use for his common trips. The information about that particular rider's pathway is entered into a database on a segment-by-segment basis, so that subsequent pathway assessments for other riders, which might involve one or more of the same segments, do not have to be re-assessed. If the pathway is determined accessible for the particular rider, he is referred to fixed-route for that trip. This information is also entered into his rider profile, so it is available to trip reservationists when the rider calls for a trip.

- Seattle METRO is the second notable exception. This agency began enforcing conditional eligibility more recently, beginning in 2003, and this includes a review of the subscription trips of all newly-certified riders. For those frequently made trips, an assessment of the pathway between the person's home and closest bus stop, and between the bus stop to the final destination is made. The pathways are reviewed on a segment-by-segment basis by a trained mobility specialist. The segments are identified using METRO's automated trip planner software, which underlies the online trip planner. If the pathway analysis finds that the rider could use fixed-route, the rider, after a 30-day transition period, becomes ineligible for that particular trip on METRO's ADA paratransit service. METRO has found its pathway assessment review program effective, and has helped a number of riders transition to fixed-route trips, with some riders now completely relying on fixed-route even for trips beyond those which METRO assessed as part of eligibility. Not only has this process assisted these riders travel more independently and at a lower fare, it has been cost-effective from METRO's perspective, when the cost per paratransit trip is compared to the cost per fixed-route trip.

Focusing on the pedestrian environment to improve fixed-route accessibility was one of several recommendations made by a WMATA Task Force comprised of persons with disabilities and their advocates. This recommendation came out of WMATA's Specialized Transportation Study in 2004, with the Task Force supporting efforts to improve accessibility of and to bus stops in the region to allow greater independence for persons with disabilities.[1]

This study undertaken by the Metropolitan Washington Council of Governments (MWCOG) on behalf of WMATA, was to develop a methodology to implement pathway analyses of frequently made trips by MetroAccess riders. This study was to also provide WMATA with a pathway assessment and a prioritization of improvements to meet the access needs of these frequently made trips. This is a key component of operationalizing conditional eligibility through the ADA paratransit eligibility process.

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[1] Specialized Transportation Study, prepared for WMATA, by KFH Group, Inc., in association with TranSystems, Inc., 2004.

# Section 2

# Summary of the Research/Analysis Used by Jurisdictions/Transit Systems Within the WMATA Service Area

Local jurisdictions as well as the Maryland State Highway Administration (MDSHA) and the Virginia Department of Transportation (VDOT) were contacted regarding any previous or current ADA pathway analyses conducted in their respective jurisdictions. The research also included identifying and contacting transit systems outside the region that are conducting pathway assessments for their paratransit riders. The following provides a summary of our findings.

## LOCAL PATHWAY ANALYSES

### State of Maryland

The MDSHA in 2006 conducted an ADA pathway assessment along all State roadways. Equipped with a GPS unit, a level attached to a medical rolling walker, and a measuring wheel, teams of two were sent out in the field to survey and assess sidewalks, curb ramps, driveways, obstructions, and pedestrian signals along all State roads.

#### *Sidewalks*

Attributes collected for sidewalks included the width and cross slope. The width of the sidewalk was characterized as either less than 4 feet, 4 to 5 feet, or 5 feet or greater. For the cross slope, actual slope information was not collected. Using a medical rolling walker with a level attached (with markings that indicated when the cross slope was out of compliance), surveyors walked the length of the sidewalk noting if the cross slope exceeded the allowable slope under Americans with Disabilities Act Accessibility Guidelines (ADAAG). Based on the availability of a sidewalk, the width, and the cross slope, the sidewalk was determined and noted as compliant or non-compliant.

### *Curb Ramps*

Curb ramps were determined to be ADA-compliant based on the observed slope measurements in the field, however, the slope measurements were not documented. If the measurements exceeded ADA guidelines, then the curb ramps were documented as non-compliant. Conversely, if the measurements met ADA guidelines, then it was documented as compliant.

### *Driveways*

Similar to the inventory and assessment of curb ramps, driveways were compliant or non-compliant based on measurements taken in the field.

### *Protruding Objects*

According to MDSHA, a protruding object is anything jutting into the pedestrian pathway that is between 27" and 80" above the surface of the walkway (i.e., a sign that sticks out into the walking path could be a protruding object even though the sign post is located outside the walkway). In addition to signs, typical protruding objects can include wiring cabinets mounted to telephone or signal poles, vegetation that has overgrown the pathway, banners, etc. The location and type (vertical or horizontal) of protruding objects was documented.

### *Pedestrian Signals*

The locations of pedestrian signals were collected and recorded.

### *Vertical Elevations*

Vertical elevation changes along the pedestrian pathway were also inventoried. Generally, these changes in vertical elevations along the sidewalk or pathway are due to cracks or separation in the sidewalk panels. Vertical Elevation changes up to 1/4" are typically allowed, while vertical changes between 1/4" and 1/2" must be beveled at a maximum 2:1 slope, and anything greater than 1/2" in the pedestrian pathway must be ramped at a maximum 1:12 (or 8.33%) slope. Crews measured and recorded the locations that had a visible separation.

## Commonwealth of Virginia

No ADA pathway assessment has been conducted in Northern Virginia.

## District of Columbia, Washington, D.C.

The District of Columbia has been developing a city-wide Pedestrian Master Plan to identify key pedestrian concerns related to safety, sidewalk gaps, the quality of pedestrian facilities, and accessibility. The initial phases of the project were to evaluate pedestrian conditions in specific areas in the District with a history of pedestrian crashes, with large numbers of people walking, and with significant barriers to walking. As part of the project, eight corridors in the District (one in each Ward) with the most pedestrians and the worst conditions for walking, were prioritized for detailed evaluation and recommended improvements. Table 2-1 provides a list of the priority corridors.

**Table 2-1: Priority Corridors**

| Ward | Corridor | From | To |
|---|---|---|---|
| Ward 1 | 16th St., NW | Spring Rd., NW | Massachusetts Ave., NW |
| Ward 2 | New York Ave., NW to NE | 7th St., NW | Penn St., NE |
| Ward 3 | Wisconsin Ave., NW | Western Ave., NW | Woodley Rd., NW |
| Ward 4 | New Hampshire Ave., NW to NE | Park Rd., NW | Peabody St., NE |
| Ward 5 | Bladensburg Rd., NE | Benning Rd., NE | Eastern Ave., NE |
| Ward 6 | M St., SW to SE | 6th St., SW | Isaac Hull, SE |
| Ward 7 | East Capitol St., NE | B St., NE | Division Ave., NE |
| Ward 8 | Alabama Ave., SE | MLK Jr., SE | Naylor Rd., SE |

For each of the corridors, detailed recommendations were developed to improve conditions for pedestrians walking along the road and crossing the road. Although a full pathway assessment was not conducted city-wide, the pedestrian infrastructure data available from the District of Columbia Department of Transportation (DDOT) includes:

- Sidewalk
- Curb Ramp (available only for the Golden Triangle Area)
- Light Poles
- Traffic Signals
- Crosswalks (available only for the Golden Triangle Area)

- Pedestrian Signal (available only for the Golden Triangle Area)
- Contours

### Montgomery County, MD

In 2004, Montgomery County conducted a full inventory and assessment of their bus stop facilities. The project included an assessment of sidewalks, curb ramps, crosswalks, pedestrian signals, and traffic signals at the bus stop location. Through the Bus Stop Improvement Program (BSIP) and coordination with the County's sidewalk program, the County has been making the necessary safety and accessibility improvements at its bus stops. The improvements follow ADA guidelines and many exceed the requirements set forth in the ADA. The improvements are limited to the immediate area around the bus stop. Available data from the County consists of the bus stop database (updated with current improvements), a sidewalk, and light pole inventory. Traffic signals are also available, but are not in a spatial format. Besides the ADA pathway assessment conducted by the MDSHA along State roads, there is no other ADA pathway assessment that has been conducted in the County.

### Prince George's County, MD

As part of the 2006 Regional Bus Stop Inventory project, all bus stop locations in Prince George's County were inventoried and assessed. For each bus stop location, sidewalks, curb ramps, crosswalks, pedestrian signals, and traffic signals were documented and assessed. Prince George's County also has a database of the traffic signals that are owned by the County. The database is in an excel spreadsheet format. Aside from the ADA pathway assessment conducted by the MDSHA along State roads and the Regional Bus Stop Inventory, there is no other ADA pathway assessment that has been conducted in the County.

### Alexandria, VA

The City of Alexandria recently completed a *Pedestrian and Bicycle Mobility Plan* which took an in-depth look at its entire pedestrian and bicycle infrastructure across the City. Using background data and an assessment of existing conditions, the City recommended accessibility improvements for those with mobility impairments, improvements to pedestrian facilities to promote connectivity and access to transit, and bicycle facility improvements to better connect residents with activity centers. As part of the project, an inventory of the existing conditions was conducted. The elements inventoried city-wide included:

- Sidewalks
- Curb Ramps

- Crosswalks
- Driveways
- Obstructions

Also in 2003 and 2004, the City of Alexandria inventoried all of their bus stop locations. The database was updated in 2007 as part of the WMATA's Regional Bus Stop Inventory. The bus stop database included pathway features at stops such as sidewalks, curb ramps, streetlights, pedestrian controls, and crosswalks as well as other bus stop related features.

**Arlington County, VA**

Aside from the Regional Bus Stop Inventory in 2006, no ADA pathway assessment has been conducted in Arlington County. However, the County does have a geodatabase of their sidewalks, curb ramps, traffic signals, and street contours.

**City of Fairfax, VA**

No ADA pathway assessment has been conducted in the City of Fairfax. Available data from the City includes traffic signals, street contours, and bus stops.

**Fairfax County, VA**

No ADA pathway assessment has been conducted in Fairfax County. Available data from the County includes sidewalks, light poles, traffic signals, crosswalks (as of 2005), pedestrian signals, street contours, and bus stops.

**Falls Church, WA**

No ADA pathway assessment has been conducted in the City of Falls Church. Available data from Falls Church includes sidewalks, light poles, street contours, and bus stops.

## SUMMARY OF LOCAL PATHWAY ANALYSES

Local major pathway analyses are limited to the efforts conducted by the MDSHA, the District of Columbia, and Alexandria. The pathway analysis conducted by Maryland was primarily along State roads, while the effort conducted by the District of Columbia targeted eight priority corridors. Alexandria's pathway analysis was city-wide.

The types of pathway data (i.e. sidewalks, curb ramps, crosswalks, etc.) that was available varied from jurisdiction to jurisdiction. Table 2-2 is a matrix summarizing the pathway data that is available from each jurisdiction.

## SUMMARY OF PATHWAY ASSESSMENT APPROACHES IN OTHER AREAS

This study also researched pathway review programs and projects in other cities. Summaries of the programs of the following agencies are presented:

1. ACCESS Transportation Systems (Pittsburgh, PA)
2. Hillsborough Area Regional Transit (HART) (Tampa, FL)
3. King County Metro Transit (Seattle, WA)
4. Washington State University for Spokane Transit (Spokane, WA)
5. Tri-County Metropolitan Transportation District of Oregon (Tri-Met)

### ACCESS Transportation Systems (Pittsburgh, PA)

Pathway reviews or environmental assessments are conducted in the Pittsburgh area in the context of the conditional eligibility determination process for ACCESS Transportation Systems, the ADA paratransit service of the Port Authority of Allegheny County. Approximately 1.2 million people live in Allegheny County.

The ADA paratransit eligibility determination program of ACCESS is a nationally renowned model that uses in-person functional assessments as well as trip-by-trip screening.

The ACCESS environmental assessments are customer-specific, with each individual customer's abilities and frequent trips determining which pathways are assessed and upon which pathway features to focus.

While ACCESS does not have a database to specifically manage or store information about pathway assessments, decisions for each trip are stored in a customer's file for his or her frequent trips, and trip eligibility determinations are manually checked against previous environmental assessment information before a new field assessment is conducted.

## Table 2-2: Data Summary by Jurisdiction

| Data Elements | Alexandria | Arlington | District of Columbia | Fairfax City | Fairfax County | Falls Church | Montgomery | Prince George's | MDOT/MDSHA [4] | VDOT |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sidewalk** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **No** |
| Width | Yes | No | No | - | No | No | No | - | Yes | - |
| Condition | Yes | No | No | - | No | No | No | - | No | - |
| Obstruction/Obstacles | Yes | No | No | - | No | No | No | - | Yes | - |
| Cross Slope | No | No | No | - | No | No | No | - | Yes | - |
| **Curb Ramp** | **Yes** | **Yes** | **Yes** [1] | **No** | **No** | **No** | **No** | **No** | **Yes** | **No** |
| ADA Compliance Info | Yes | No | No | - | - | - | - | - | Yes | - |
| **Crosswalk** | **Yes** | **No** | **Yes** [1] | **No** | **Yes** [2] | **No** | **No** | **No** | **No** | **No** |
| **Light Pole/Utility Poles** | **No** | **No** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **No** | **No** | **No** |
| **Pedestrian Signal** | **Yes** | **No** | **Yes** [1] | **No** | **Yes** | **No** | **No** | **No** | **Yes** | **No** |
| **Traffic Control Signal** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** [3] | **No** | **No** |
| **Street Contours** | **No** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **No** | **No** |

[1] Golden Triangle Area only.

[2] As of year 2005.

[3] Only on County roadways.

[4] Only on State roadways.

The accessibility features of the infrastructure that are examined as part of each individual's functional ability relative to the environment in which they must travel include:

- hills and terrain (Pittsburgh is a particularly hilly city)
- lack of /inaccessible curb cuts and other obstacles for people who use wheelchairs
- berm of road without sidewalk less than 5 ft. from quickly moving traffic (a safety concern)
- accessibility of the bus stop itself
- wide open parking lots and other poorly defined paths of travel (which do not provide landmarks for people who are blind and have to navigate with a cane)
- obstacles at head or chest level (which people who are blind are unable to detect with a cane)
- intersections/street crossings

ACCESS Transportation Systems developed *Guidelines for Evaluating Environmental Barriers*, published with *Determining Eligibility for Individuals with a Visual Disability* in 1996 for Easter Seals Project ACTION. Attached as Appendix A is the Environmental Analysis Checklist included in this report.

The Physical Functional Abilities Assessment Form included in the Easter Seals Project ACTION publication *Determining ADA Paratransit Eligibility: An Approach, Guidance and Training Materials,* developed by TranSystems and ACCESS Transportation Systems, includes the following customer evaluation factors related to a pathway review:

- Walking endurance
- Walking speed
- Ability to navigate around
    - large obstacles (trees, fire hydrants) or
    - small objects (raised utility boxes/pipes)
- Ability to independently locate and maneuver up or down a curb-cut
- Ability to independently step up or down a 6″ curb
- Ability to negotiate on:
    - broken pavement/surfaces,
    - uneven/grassy surfaces,
    - gravel surfaces, or
    - loose dirt/sand surfaces

- Ability to negotiate up or down a:
    - 30′ ramp with a 1:16 or 1:12 slope, or
    - 16′ ramp of 1:8 slope
- Ability to negotiate cross-slope of 1:20 (5%)
- Observations of the applicant's ability to negotiate street crossings.
    - The characteristics of the intersection include:
        - number of lanes/distance in feet
        - presence of crosswalk
        - traffic signals
    - The customer's abilities assessed include:
        - independently activate "Walk" light
        - Safely initiated crossing from curb/curb-cut
        - Walking speed (feet per second)

In assessing the accessibility of a particular trip for an individual, ACCESS staff may work with community partners, including travel instructors, Orientation & Mobility Specialists, the center for independent living, the city planning office, and transit road supervisors. Inaccessible stops and pathways identified by ACCESS staff are reported to fixed-route planners for planning improvements.

It is important to note that, while ACCESS has a rigorous screening process for trip eligibility and paratransit eligibility, the agency is committed to ensuring that people receive the services they need and qualify for under the ADA. The physical environment is only one piece of the puzzle. A customer's ability to negotiate the environment may also vary according to the time of day, the weather, and how the customer's disability affects his or her abilities from day to day. Safety is also a concern, and ACCESS environmental assessments reflect that. For example, if a road has no sidewalk and the customer would have to travel less than 5 feet from quickly moving traffic, the pathway would be considered unsafe and the trip would therefore be eligible for ADA paratransit.

### Hillsborough Area Regional Transit (Tampa, Florida)

A Bus Stop & Facility Accessibility Study was recently completed for HART, which operates in a county with a population of approximately 1.16 million. The study included an inventory and assessment of HART's approximately 4,000 bus stops, and the assessment addressed pathways from each stop to destinations near the stop. Pathways within and adjacent to 11 transfer centers and 20 park-and-ride facilities were also assessed as part of this study.

Consultant staff used GPS-enabled Trimble units to update the 2003 bus stop inventory (which included GPS locations) and collect assessment data. As listed in the final report for the study, the questions addressing pathway assessment included the following, based on ADAAG standards:

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***Presence of Accessibility Features***

- Is there a landing area located at the bus stop and adjacent to the curb/street? (Y/N)
    - If yes, is there any obstruction at or near the bus stop landing area? (drop down)
        - No obstruction
        - Utility pole or guide/tension wires
        - Fixed street furniture (control boxes, waste cans, benches, etc.)
        - Moveable Street furniture (waste cans, benches, etc.)
        - Other (specify)________________
    - If yes, are there any physical barriers that constrict the width or height of the path from the landing area to the accessible entrance? (drop down)
        - No barriers
        - Building or other structure
        - Fencing, curbs, sign posts, etc.
        - Other (specify)_________________
    - If yes, what material adjoins the bus stop landing area? (drop down)
        - Concrete or asphalt
        - Dirt/Grass
        - Other (specify)____________
    - If yes, are there any changes in elevation greater than ¼ inch along the path from the bus stop landing area to the accessible entrance? (Y/N)
    - If yes, are there any signs that provide directions to the accessible entrance from the landing area? (Y/N)
    - If yes, how wide is the sidewalk, or other walkway, connecting the landing area to the nearest accessible entrance? (input width)
    - If yes, is the sidewalk surface firm, stable, and slip resistant? (Y/N)
    - If yes, what is the cross slope of the sidewalk or other walkway? (Specify)_______

- Are there curb ramps along the path from the bus stop landing area to intersecting walkways or to the accessible entrance? (Y/N)
  - If yes, do they have detectible warnings? (Y/N)
  - If yes, is the curb ramp(s) located or protected to prevent their obstruction by parked vehicles? (Y/N)
  - If yes, are the transitions where the curb ramp(s) meets the sidewalk and where it meets the street or gutter flush with no abrupt change? (Y/N)
  - If yes, is the slope of the curb ramps 8.3% or less? (Y/N)
  - If yes, is the surface of the curb ramp stable, firm, and slip resistant? (Y/N)
  - If yes, is the width of the ramp portion of the curb ramp 36 inches or more? (Y/N)
  - If yes, is the curb ramp located where the walking surface at the top of the ramp is less than 48 inches wide and pedestrians must walk across the ramp? (Y/N)
  - If yes, are the side slopes 8.3% or flatter? (Y/N)

Source: Tindale-Oliver & Associates, Inc. and TranSystems, *Hillsborough Area Regional Transit Bus Stop & Facility Accessibility Study* (Jan. 2008), Appendix A, pages 5-7.

The responses to these questions were supplemented by digital photographs of the approaches to the bus stop. Proprietary software was used to synchronize the digital photos with their respective bus stop records during processing following the field collection.

The study scored and ranked each bus stop for improvement priority based on many variables, including several related to the pathway conditions. Because the study focused on the stops and the improvements were considered HART's responsibility, the pathways themselves were not ranked independently of the stops to which they connected. However, sidewalk and curb ramp improvements were included as part of the package of improvements recommended for each stop. Those improvements which could be included within or "piggy-backed" on planned roadway, sidewalk, and bicycle projects were identified. Also, GIS analysis was used to determine jurisdictional responsibility, so that HART could easily identify to which jurisdiction information about sidewalk and curb ramp deficiencies should be directed.

Further, planned sidewalk or roadway improvement projects within the Hillsborough County Metropolitan Planning Organizations' Transportation Improvement Program (FY 2008-2012) were cross-referenced to the HART bus stops that fell within each improvement area. Highway widening, enhancement, pedestrian, and bicycle projects in the Long Range Transportation Plan were also cross-referred to bus stops. This provides HART with a resource for anticipating planned sidewalk improvements and making specific requests related to bus stops within each project.

An implementation plan was developed as part of the five-year improvement plan. The plan includes integration of the inventory database in the paratransit scheduling software. It also recommends that the updated inventory be utilized by Customer Service, Service Planning, and Scheduling staff to access information on and photographs of each stop, and that the feasibility of making such information available to the public on the Internet (including Google Maps, with whom HART has already partnered to share trip planning software) be explored.

At the time of this survey effort, the recommendations were being finalized so no improvement recommendations have been made.

### King County Metro Transit (Seattle, WA)

King County Metro Transit is headquartered in Seattle and serves the 2,134 square mile area of King County, Washington (population 1.82 million). The Accessible Services group within King County Metro Transit assesses pathways to and from bus stops in the context of determining trip-by-trip eligibility for individuals who are conditionally eligible for the ADA Paratransit Program. Called ACCESS, the ADA Paratransit Program provides approximately 1.12 million trips per year for people who are unable to ride the fixed-route service. King County began applying conditions to ADA paratransit eligibility in 1993; this became more comprehensive in 2000. In 2002, the agency began to conduct reviews of pathways for all new or changed standing order (subscription) rides for customers with conditional eligibility, and late in 2005, this was expanded to review frequently scheduled demand trips.

Accessible Services' contract staff who conduct the pathway reviews are within the same team who provide travel training. While the pathway review program is focused on identifying trips for which a customer would not be eligible for paratransit, this program works hand in hand with the program that helps customers learn to ride fixed-route. Thus, ultimately, a customer's mobility independence is enhanced, while at the same time the transit system can reallocate resources that would otherwise be spent to provide trips not required under the ADA.

The pathway accessibility analysis is only one factor, though an important one, in King County's comprehensive eligibility determination process. For any particular customer's trip, there are other conditional eligibility factors that are used to determine eligibility, including:

- distance of travel to the bus stop,
- weather and seasonal conditions,
- hours of darkness or bright light,
- whether or not the customer has been travel trained on the trip, and
- if the customer has a disability with varying or episodic conditions, or whether or not they are having a good or bad day related to their disability. For example, a customer with multiple sclerosis may be able to use fixed-route service on days when they are not experiencing symptoms.

If a customer has any of these other conditions, they will always trump the pathway accessibility when applicable.

While the exact number of assessments conducted since the program's onset is unknown, there are approximately 700 customer folders that contain trip assessment records (typically 2-5 trips per customer, with multiple segments within each trip). The program has grown considerably in the past two year; an estimated four times as many assessments have been conducted during this period than in the initial three years of the program. Pathway review program budget information was requested, but was not readily available. Staff indicated that a formal cost/benefit analysis has not been conducted; however, demand for paratransit services was less in 2007 than 2006, with the cost of operations coming in more than $1 million under budget.

### *Which Pathways are Assessed?*

King County approaches pathway reviews by targeting the specific travel patterns of individual customers, specifically those who make a frequent trip on paratransit, because they found this best allocates staff resources. Early on in the program, the County took a systematic approach to key destinations and services areas. However, over time, the program approach evolved to prioritize frequently-requested trips for greatest impact.

- **High-volume destinations:** Early in the program, the County started with a review of the top 100 destinations of paratransit customers. However, they found that this single criterion was not always the most efficient process for reducing paratransit trips, since one destination may be surrounded by multiple bus stops served by different routes. The individual customer's trip origin would determine which stop would be the closest for their particular trip.

- **Sweep of high density urban core:** Also early in the program, the County conducted a full "sweep" of the downtown core area of Seattle, encompassing the fixed-route "ride free" area extended as far north as Denny Way. This was found to be an efficient means of covering a relatively small area (approximately 105 square blocks) with a high concentration of rides, served by many bus stops and routes, some located on a steep slope.

- **Subscription trips:** Trips that are scheduled by conditionally eligible customers as standing-order or subscription rides are prioritized for a pathway review, since these are the most frequently-taken trips, and the ability to used fixed-route on these trips will have the greatest impact on changing a paratransit trip to a fixed-route trip.

- **Frequently-scheduled trips:** Beginning November 28, 2005, customers who are newly certified or recertified for paratransit are also prioritized for pathway reviews for not only their subscription trips, but for other frequently-scheduled trips as well. The threshold for determining the need for a pathway review is whether or not a customer schedules a ride with the same origin and destination at least eight times within a 90-day period. (This was initially set at 10 times per 90 days, but the program found it could accommodate trips that meet the lower threshold.)

### *Preparing to Conduct an Assessment*

Once or twice a week, priority trips (i.e., subscription or other frequently scheduled trips by a conditionally eligibility customer) that are pending pathway reviews, are queried from a master Excel spreadsheet in which priority trips are stored.

For each trip to be reviewed, an Excel worksheet is prepared with fixed-route trip planning information which breaks down the trip into its various segments. This worksheet is printed and used for noting findings in the field.

Regional Automated Trip Information Software (ATIS), which powers King County's online trip planner at http://tripplanner.metrokc.gov/, is used to plan the fixed routes. Bus stop accessibility, walking distance, travel time, and transfer limits are variables that help target the best fixed routes for a particular customer's trip.

Each pathway review includes multiple segments that make up a complete customer trip:

- The path of travel from the curb[1] of the origin to the closest bus stop served by the route the customer would need to take to make the trip on fixed-route.

- If there is a transfer between routes, the path of travel between deboarding the first route and boarding the second route. For the purposes of the paratransit trip comparison to fixed-route, a maximum of two transfers, or three buses, on the fixed-route system is considered.

- The path from deboarding the final route to the curb[2] of the destination.

The return trip is also assessed, taking into account return routing and bus stops. The inbound route may not be the best outbound route.

The next step is to check the master MapPoint file to see if any assessments have already been conducted for the segments to be reviewed, to avoid potential duplication of effort. If a segment has already been assessed, the data from the previous assessment is copied and pasted into the current trip's workbook. Currently, staff who administer and perform pathway reviews do not have GIS mapping tools through which data could be linked, though they hope to have this capability in the future.

For each segment to be assessed, an enlargement of the map is printed out. This printout is also used to record information during the field assessment. To the extent possible, field work is planned so that assessments are grouped with others in the same general area.

Equipment used in the field includes a measuring wheel (to measure walking distances), an inclinometer (a device similar to a level to measure percent of incline), a tape measure (to measure clearances if there are barriers), a paper tablet, a digital camera, and a tablet PC. The tablet PC is used to enter information into the Excel workbook.

### *Assessment Procedures*

In the field, the person conducting the review visually scans walking pathways between the door (or nearest public right of way) of the origin/destination, and the bus stops which would be needed to travel both to and from the origin/destination. If any obvious barriers are noted in the quick scan, alternative pathways are identified if possible.

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[1] Or rather from the public right-of-way closest to the door of the customer's origin, since the County does not assess private property.

[2] Or to the end of the public right-of-way closest to the door of the customer's destination.

Next, the length of the entire pathway (in each direction) is measured from the bus stop sign pole to the end of the right of way closest to the accessible entrance of the origin/destination. Street crossings are included. The walking path and measurements are noted on the MapPoint printout.

The reviewer also checks for the following items along the route:

- percent of incline if over 4% (if close to 8%, several measurements are taken along the way, since King County's standard of inaccessibility for someone in a manual wheelchair is 8%)
- curb cuts/accessible street crossings
- uneven terrain
- narrow pathways
- any other barriers

Comments are recorded using pencil and paper, to be entered into the Excel workbook using the tablet PC. Digital photos are taken of the bus stops and any barriers identified en route. These are saved to a master photo file folder.

If the most direct pathway has problems, the reviewer also checks alternative paths which may be less direct but accessible, keeping notes to be able to instruct the customer how to achieve this path. For example, if there is a problem with the sidewalk on one side of the street, the customer may still be able to travel to complete the trip by crossing the street, traveling along on the other side, and crossing back over to the original side. Sometimes this may involve traveling to another bus stop. This indirect path will still need to be within the customer's distance travel abilities to be an effective alternative.

### *How the Results of the Assessments are Documented*

The results of the assessment of each trip, including any barriers noted within each segment, are recorded in an Excel workbook, along with digital photos of the bus stop and any barriers. Each trip spreadsheet is cataloged by customer, since the details of the complete origin-to-destination are specific to a customer's travel abilities and needs. The workbook and worksheets were developed by the County and contract staff, and have been refined to best meet Accessible Services' need for individual customer trip records. The findings on the trip assessments for all segments are stored in a master Excel spreadsheet, also organized by customer name, including origin and destination information.

When a pathway is assessed, each segment's assessment area is also drawn as a line segment onto a MapPoint file, with identified barriers indicated by points and details noted for the point. Accessible Services staff indicated that one of the shortcomings of this mapping system is that the files cannot be shared with other groups such as fixed-route transit planning, or city pedestrian planners. Conversely, GIS files from other groups cannot be imported into the MapPoint file maintained by the Paratransit eligibility department. However, it does provide Accessible Services a visual way to identify which segment has already been assessed, and the information for that segment can then be applied to other customer trips which include the same segment, thereby eliminating potential duplication of effort. Ideally, however, paratransit would like to have GIS capabilities, and be able to overlay trip assessments with bus stop locations and information. This would also allow Accessible Services to more easily query the assessment information.

### *How the Assessment Findings are Used*

- **Information used for ADA paratransit scheduling:** If there are no barriers identified on any of the segments of the customer's trip from origin to destination, the trip is considered "not qualified" for ADA paratransit for that customer, unless the customer has another overriding condition that would prevent the use of fixed-route. Notification is provided to the customer as well as detailed instructions on how to make the trip on fixed-route, including specific directions on which side of the street to travel. The customer can appeal the decision if he believes that a barrier was overlooked, and in this case, the county will send out a different assessor to double-check. However, it is rare that the first assessor's assessment is found to be in error.

  Each trip which has been determined as "not qualified" is noted in the customer's record within the dispatching and scheduling system (Trapeze), manually entered along with any other conditions applicable to that customer's eligibility. Then, each time a customer calls to request a trip, the person taking the reservation is alerted to any conditions attributed to that customer by a pop-up window. This approach was developed by King County Metro Transit staff. A comprehensive decision-making flow chart, also developed by County staff, guides the reservationist in applying the individual customer's conditions, with the accessible pathway factoring in after several overriding levels of decisions are first made. The ACCESS call center schedules up to 4,000 trips per day, and this decision-making tool ensures that conditional eligibility is clearly defined and smoothly applied for each customer on a trip-by-trip basis.

- **Information is shared to help improve bus stops:** If discrepancies are found with the bus stop accessibility data, the Accessible Services group alerts the Route Facilities group (which plans facilities along fixed routes) of King County Metro Transit, so that the bus stop database can be updated. Accessible Services may also recommend accessibility improvements to bus stops to this group. If maintenance or repair needs are identified, these are directed to the King County Metro Transit's Facilities Maintenance group.

- **Information is shared to help improve sidewalks:** Accessible Services also sometimes sends requests to fix sidewalk problems to the local jurisdiction responsible for the sidewalk. With 32 cities within King County Metro Transit's service area, such requests are met with varying responses. In general, if a problem is easily corrected, such as requiring a business to move a sandwich board out of the path of travel, it is likely to be addressed by the city. If an improvement would require construction, it is less likely to be addressed unless the city is already working on improving pedestrian facilities. Bellevue and Seattle were noted as being particularly proactive in this regard.

### Washington State University (WSU) for Spokane Transit (Spokane, WA)

WSU's Geographic Information Systems & Simulation Laboratory (GISSL) is developing a geospatial model for mapping pedestrian networks and analyzing the accessibility of these travel paths. The model will provide individuals who use wheelchairs with information on how best to travel between bus stops and their origins and destinations.

This project is part of a program known as Lifeplan Improvement through Feasible Transportation Services, or LIFTS, funded with a Job Access and Reverse Commute (JARC) grant. The local match for the JARC grant is provided through Spokane Transit Authority (STA) and is part of a Special Needs Transportation grant from Washington State. The LIFTS program has been developed by a local consortium led by the transit agency.

Now in its fourth year, LIFTS has a focus on helping Work First clients to access employment, job training, childcare, and affordable housing. The GISSL project originally started as a pilot project within the service area of one Spokane Transit route, but a major increase in funding in its third year enabled the GISSL to expand the scope of the pilot to cover the entire Spokane Transit service area of 375 square miles. The locations of the origins and destinations of WorkFirst clients are key endpoints of the pedestrian network for this project.

The total budget for the geospatial model and accessibility analysis project (including hardware and some personnel costs not strictly for the pedestrian mapping) is approximately $390,000 over three years (2006-2009).

### *Development of Base Maps*

Before beginning the fieldwork to assess conditions, the pedestrian network was mapped in a linear form using existing street centerlines, Spokane sidewalk maps, and high-resolution aerial photography. Points indicating locations of Spokane Transit bus stops, which were previously gathered by the transit system using handheld Trimble units, also are layered into the map. Existing shape files were fine-tuned to align with the aerial photos. To the extent surface conditions and problems in the sidewalk were visible on the photos, these were noted in the attributes of the line segment.

### *Field Assessments*

Two students working full-time over the course of two summer months, completed the fieldwork. They gathered information on the location, configuration, dimensions, and slope of every curb ramp, as well as sidewalk conditions, with a particular focus on the ADAAG compliance of the curb ramps. Point data were gathered to precisely locate each ramp.

Based on 2006 experience in using hand-held Trimble units to cover the initial pilot area, the GISSL determined that these units were not the best choice for collecting data on curb ramps. This decision was based in part because of the need for greater precision than plus or minus one meter (which resulted in time spent realigning points to match the aerial photo) and in part because the Trimble unit memory was too small for the number of measurements needed to plot out each curb ramp. Thus, tablet PCs were used to gather data in the field for the rest of the Spokane Transit service area.

Each curb ramp was located, categorized, and measured for ADAAG compliance. The slope of each ramp was measured using a tool called a "slopometer." Designed by one of the graduate students working on the project, this tool resembles a large t-square and has a measuring gauge attached.

Impedance values of segments of the pedestrian network also were developed, based on research conducted in the U.K. called the MAGUS project (Modeling Access with GIS in Urban Systems). These values indicate the degree of difficulty of traveling in a wheelchair over a surface based on surface conditions, slope, and the type of wheelchair used.

### *Project Outcomes*

The GISSL has gathered the geospatial and condition data, corrected it using the aerial photographs, and is nearing the completion of the fine-tuning process. Anticipated for later in 2008 is the unveiling of the LIFTS Web-based GIS tool that will enable customers to identify accessible routes in the pedestrian network between bus stops and employment and job training sites, childcare facilities, and affordable housing. A second website will be deployed allowing users to examine accessibility factors and to post possible issues and edits back to the site. Using these tools customers with mobility impairments will be able to plan their bus trips from actual origin to destination, knowing in advance the locations of curb cuts, accessible sidewalks, and accessible street crossings.

The data gathered to build the tool also serves as a needs assessment, which also can be used to support requests to fund improvements in the pedestrian network. For example, 48% of the curb ramps in the Spokane Transit service area do not meet minimum ADAAG standards.

The results are being and will be shared with Spokane Transit, the various municipalities, and citizens and neighborhood groups with funds for sidewalk repairs. Thirteen neighborhoods in Spokane, designated Community Development neighborhoods, receive Community Development Block Grants that can be used for sidewalk repairs, and the GISSL has provided sidewalk data to several neighborhoods for this purpose. The data will also likely be used for regional efforts, including the development of a Regional Master Pedestrian Plan for the Spokane area (recently begun).

In the near future, the GISSL will put the data on a website where it may also be used to identify and report possible areas for capital improvements.

Eventually, Spokane Transit would like to incorporate the data set into their paratransit scheduling software to assist in determining the barriers a customer faces when attempting to access a fixed-route bus.

## Tri-County Metropolitan Transportation District of Oregon

TriMet operates bus, light rail, streetcar, and paratransit services in the metropolitan area of Portland, Oregon. TriMet is currently developing a Barrier Application tool to be used not only for paratransit eligibility purposes, but also as a public trip planning map on the TriMet website.

TriMet's ADA paratransit service, known as LIFT, is operated in coordination with Ride Connection, a nonprofit community service organization which coordinates a network of over 30 specialized transportation providers. While LIFT customers may be certified as conditionally eligible, TriMet does not currently administer paratransit eligibility on a trip-by-trip basis.

Pathway assessments are conducted for LIFT eligibility purposes on an occasional basis only, and are typically between the customer's home to the closest bus stop, or based on requests from customers or TriMet staff. TriMet's pathway review for paratransit eligibility addresses slope, surface type and conditions, curb cuts, width, and walking distance, as well as considerations related to the customer's mobility device and vehicular access to their address.

Pathways are evaluated based on both ADAAG and local guidelines, including those of TriMet and the local jurisdiction where they exist. In general, these local requirements are more stringent than those of the ADAAG, including wider minimum sidewalk widths and larger bus stop landing areas.

The assessment information for individual customer pathways is stored electronically, is accessible by customer name and address, and is generally limited to staff involved in eligibility determination and updating operator manifests.

The Barrier Application under development is built on open source technologies including GeoServer, OpenLayers, PostGIS, and Apache and combines information from various sources (TriMet Trip Planner, Google Streetview, Microsoft Virtual Earth, Google Maps for driving directions, regional data, and transit data) into one integrated mapping application. Barrier identification is based largely on street views and aerial photography, with site visits confirming information available through these sources.

Once complete, the Barrier Application will replace the interactive system map that is currently on TriMet's website, and will also provide a mapping interface for TriMet's online trip planner. Staff involved in ADA paratransit eligibility determination will also be able to use the application to identify barriers that would impact paratransit eligibility. Currently, TriMet LIFT staff and Ride Connection are using the application in beta form.

The final application will include tools to measure distance and identify stops within a specified walking distance, service area provider boundaries, contours, major changes in elevation, sidewalk features, and transfer points to other providers.

# Section 3

# Cluster Analysis

This section of the report provides the approach that was undertaken in analyzing and identifying MetroAccess' top 20 origin and destination pairs in terms of high concentrations of trip activity, to be used in the Supplemental Pathway Analysis. The cluster analysis was based on a comprehensive list of all MetroAccess trip requests for the month October 2007. In that time period, approximately 177,949 trips were requested on MetroAccess.

Two approaches to this cluster analysis were considered. The first approach was to summarize the trip data by Census geography (e.g. Census tract or block group) to identify the largest clusters of trip ends. The second approach was to summarize the trip information by the actual location of the destinations and origins.

It was felt that the second approach would provide a more precise analysis since the addresses of both the origins and destinations were available in the October 2007 MetroAccess trip data. In addition, walk paths typically vary from location to location, even if the locations are in the same geographical boundary, such as a block group or block. Though there may be some common segments along the walk path for two or more locations in the same area, there would be variations in the overall walk path.

The types of information provided in the MetroAccess data included:

- Booking ID
- Client ID
- Service Date
- Booking Type
- Status of Trip
- Trip Request Time
- Pick-up and Drop-off Address Type (client home, location)
- Pick-up Location (name of location)
- Pick-up and Drop-off Address (street, city, state, and zip code)
- Longitude and Latitude Coordinates of Pick-up and Drop-off Location

It should be noted that some information (i.e. pick-up and drop-off location, pick-up, and drop-off address type) in the MetroAccess dataset was incomplete.

## APPROACH

The first step was to determine the top destinations from the 177,949 MetroAccess trip requests in October 2007. This was accomplished by summarizing the drop-off street address to identify the locations with the most activity to that drop-off location. Summarizing the data in this manner provided a count of requested trips, or trip count, to unique drop-off locations. Once these destination locations were established, the addresses were sorted by the trip count and the top 100 destinations were selected. The initial process of managing the dataset identified 31,198 trip origins to the selected top 100 destinations. The next process was to summarize the 31,198 trip origins to determine the level of activity and number of unduplicated clients to each of the 100 destinations.

To determine the client activity, or total number of requested trips from an origin to its destination, the pick-up street addresses for the 31,193 trip origins were summarized. The client activity was sorted in descending order, ranked, and scored. In situations where the client activity is identical, the origins were given the same score. Therefore, origins with a high level of activity were ranked higher than those with lower activity.

To determine the client count, or total number of unduplicated clients, the client identification numbers for the 31,193 trip origins were summarized. The resulting number is a representation of the number of unique participants residing at a particular origin that travel to the paired destination. The client count was then sorted in descending order, ranked, and scored. In situations where origins have the same number of clients, the origins were given the same score. Therefore, origins with a higher number of clients were ranked higher than those origins with fewer clients.

Following the client activity and client count rankings, a composite client score was determined for each unique pairing of origin and destination. The composite client score is the sum of the client activity and client count scores. A lower composite client score is an indication of an origin having both high client activity and client count.

Within the abridged list of 100 destinations, three filters were applied, leading to the exclusion of: dialysis centers (to the extent that was possible); destinations found within one city block; and destinations that are located outside the transit shed. Dialysis centers were excluded, because of the likelihood that many of these trips could not include a return trip to the origin via fixed-route, due to the physical strain of the medical treatment. In order to provide an opportunity to test the methodology elsewhere in the region, if destinations were found near one another only one was used. Destinations outside the transit shed, which is a buffer of one-half mile around Metro Rail stops and one-quarter mile around regional bus stops, were excluded because of the nonexistent option to conveniently access a fixed-route service. Once the filters were applied, a final list of 20 destinations was compiled and matched to the associated origins.

In determining the pairing of an origin to the 20 selected destinations, the origins for each of the 20 destinations were sorted from lowest to highest client score. Then the origin associated to the destination with the lowest client score was selected, and two filters were applied for final qualification. The first origin filter excluded locations already selected as one of the destinations, so as not to duplicate any existing pathway. The second filter for the selected origin excluded any location existing outside the same transit shed; the same criteria and reasoning as the filter applied to the destinations. If the top origin failed either of these filters, then the origin with the next highest client score was selected until an origin was found for the destination that passed the necessary requirements. It was in this manner that the pathways for the 20 origins and destinations were selected for analysis.

Table 3-1 provides a list of the final top 20 origin and destination pairs. It should be noted that in the original top 20 list, one of the destinations - the Supported Employment Enterprise Corporation (SEEC) of Gaithersburg on Conservation Lane was later determined in the field analysis to be no longer there, even though it was in the October 2007 MetroAccess trip file. The tenant across the office from where SEEC was located indicated that the SEEC had moved a few years ago to Silver Spring. In place of this trip, the next highest activity destination was used.

Figures 3-1 and 3-2 provide a map of the 20 origin and destination pairs. Figure 3-1 depicts the top tier of the origin and destination pairs, while Figure 3-2 shows the second tier.

## SUMMARY

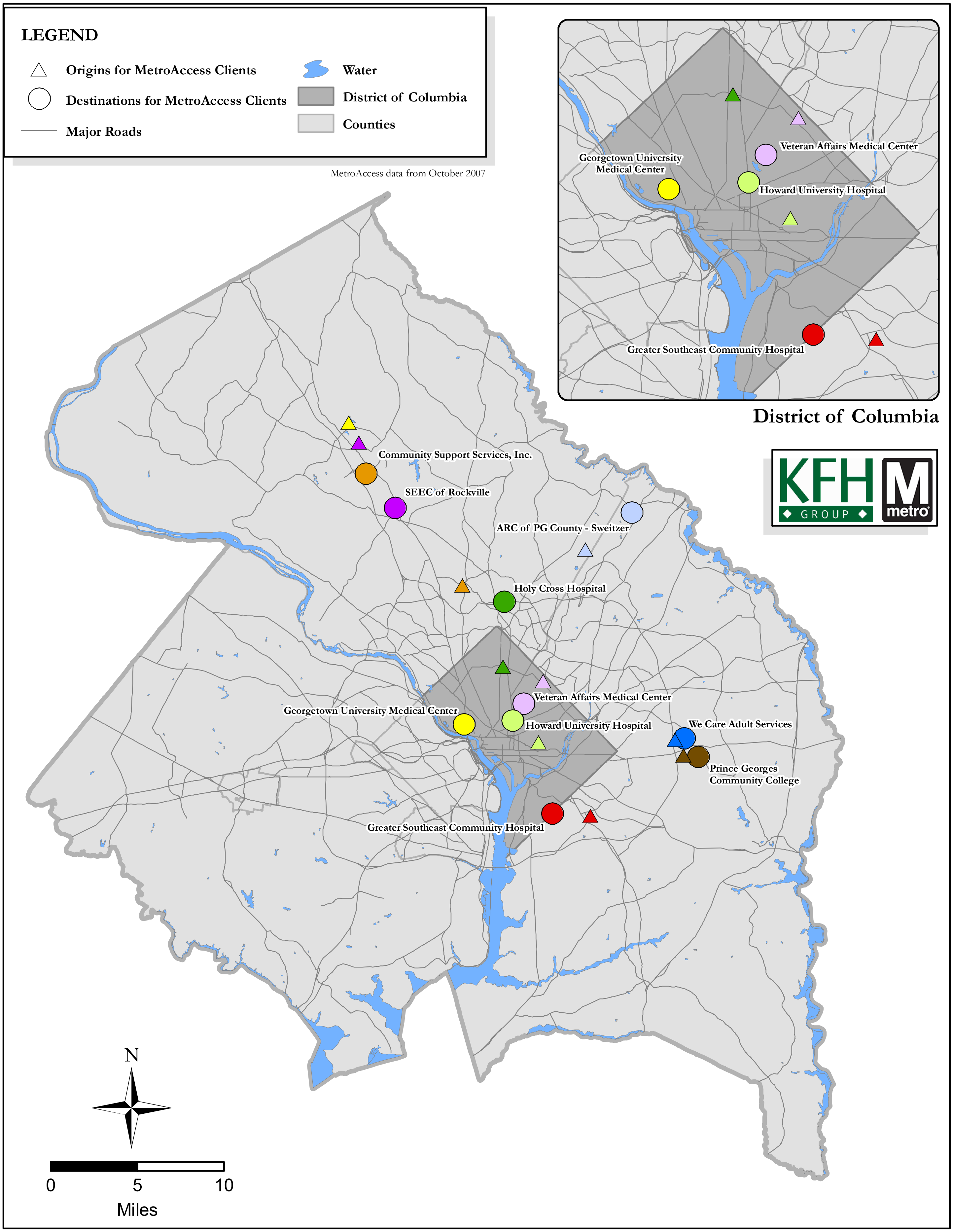
Through this analysis, certain trends were noticed concerning the location of the selected destinations and origins by jurisdiction, as well as the traveled pathway connecting the pairings. The first analysis concerning the location of the top 20 destinations found the following:

## Table 3-1: Top 20 Destinations and Corresponding Origin with Highest Client Score

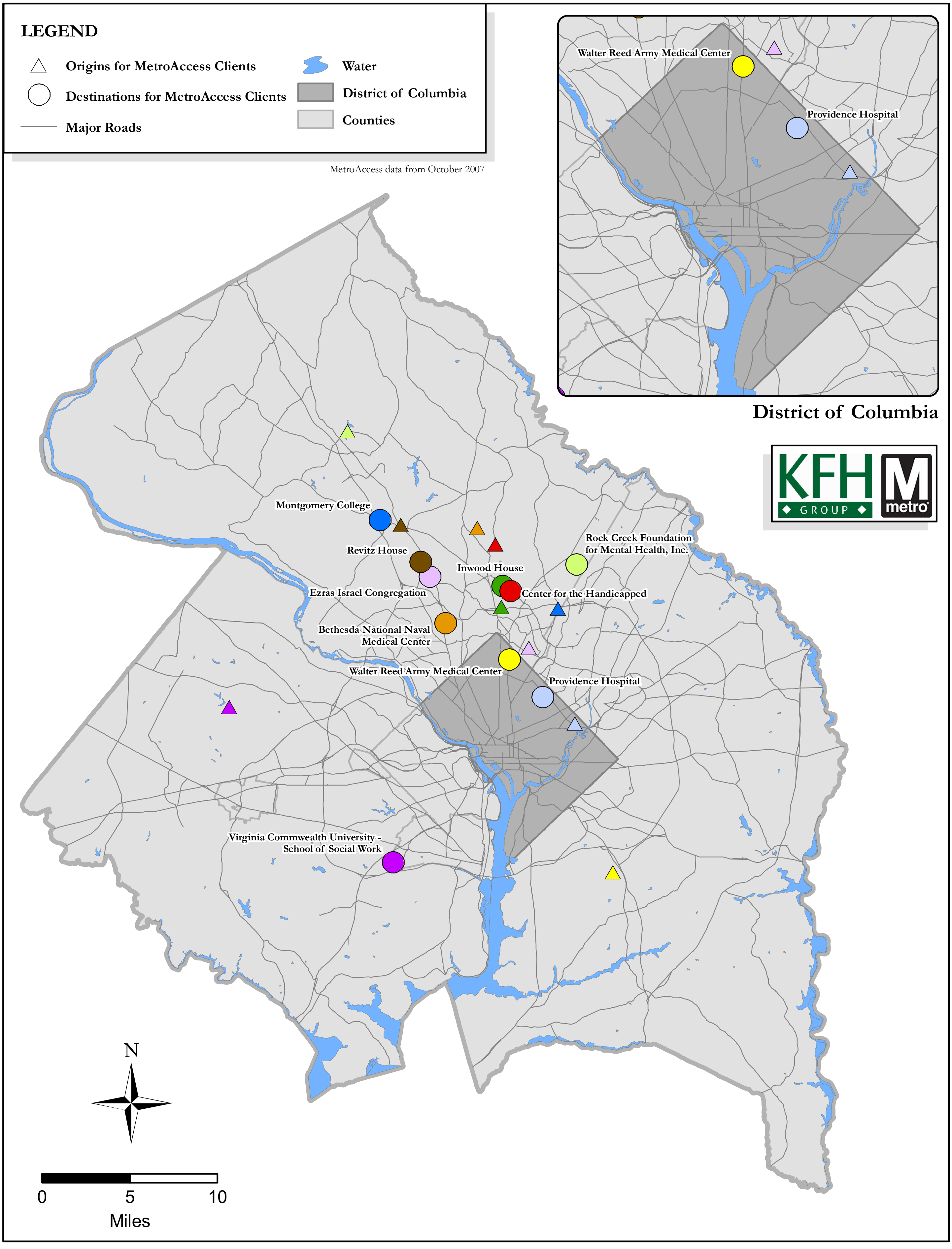
| | Destination (Drop-Off) Information | | | | | Origin (Pick-Up) Information | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Trip Count | Location | Address | City | State | Client Score* | Address | City | State |
| 1 | 2,130 | We Care Adult Services | 1101 MERCANTILE LN | UPPER MARLBORO | MD | 12 | GOLDEN CORAL | UPPER MARLBORO | MD |
| 2 | 1,544 | ARC of Prince Georges County - Sweitzer | 14750 SWEITZER LN | LAUREL | MD | 15 | RESIDENCE | CALVERTON | MD |
| 3 | 1,168 | Supported Employment Enterprise Corporation of Rockville | 622 HUNGERFORD DR | ROCKVILLE | MD | 26 | RESIDENCE | GAITHERSBURG | MD |
| 4 | 812 | Veteran Affairs Medical Center | 50 IRVING ST NW | WASHINGTON | DC | 32 | RESIDENCE | WASHINGTON | DC |
| 5 | 496 | Holy Cross Hospital | 1500 FOREST GLEN RD | SILVER SPRING | MD | 42 | RESIDENCE | WASHINGTON | DC |
| 6 | 471 | Georgetown University Medical Center | 3800 RESERVOIR RD NW | WASHINGTON | DC | 39 | RESIDENCE | MONTGOMERY VILLAGE | MD |
| 7 | 457 | Community Support Services, Inc. | 9075 COMPRINT CT | GAITHERSBURG | MD | 44 | RESIDENCE | KENSINGTON | MD |
| 8 | 433 | Prince George's Community College | 301 LARGO RD | UPPER MARLBORO | MD | 39 | RESIDENCE | UPPER MARLBORO | MD |
| 9 | 423 | Greater Southeast Community Hospital | 1310 SOUTHERN AVE SE | WASHINGTON | DC | 54 | RESIDENCE | SUITLAND | MD |
| 10 | 421 | Howard University Hospital | 2041 GEORGIA AVE NW | WASHINGTON | DC | 48 | RESIDENCE | WASHINGTON | DC |
| 11 | 393 | Montgomery College | 51 MANNAKEE ST | ROCKVILLE | MD | 35 | RESIDENCE | SILVER SPRING | MD |
| 12 | 377 | Providence Hospital | 1160 VARNUM ST NE | WASHINGTON | DC | 41 | RESIDENCE | WASHINGTON | DC |
| 13 | 366 | Virginia Commonwealth University - School of Social Work | 6295 EDSALL RD | ALEXANDRIA | VA | 42 | RESIDENCE | RESTON | VA |
| 14 | 334 | Ezra's Israel Congregation | 11215 WOODGLEN DR | ROCKVILLE | MD | 25 | RESIDENCE | TAKOMA PARK | MD |
| 15 | 329 | Inwood House | 10921 INWOOD AVE | WHEATON-GLENMONT | MD | 29 | 9805 DAMERON DR | SILVER SPRING | MD |
| 16 | 293 | Rock Creek Foundation for Mental Health, Inc. | 12120 PLUM ORCHARD DR | SILVER SPRING | MD | 44 | RESIDENCE | GAITHERSBURG | MD |
| 17 | 289 | Walter Reed Army Medical Center | 6900 GEORGIA AVE NW | WASHINGTON | DC | 44 | RESIDENCE | TEMPLE HILLS | MD |
| 18 | 266 | Bethesda National Naval Medical Center | 8901 WISCONSIN AVE | BETHESDA | MD | 44 | RESIDENCE | SILVER SPRING | MD |
| 19 | 250 | Revitz House | 6111 MONTROSE RD | ROCKVILLE | MD | 43 | RESIDENCE | ROCKVILLE | MD |
| 20 | 244 | Center for the Handicapped | 10611 TENBROOK DR | SILVER SPRING | MD | 44 | RESIDENCE | SILVER SPRING | MD |

*Client Score is a composite score derived from the ranking of client activity (trips) and client count (participants) from an origin to a particular destination.

Figure 3-1: TOP TIER (1-10) DESTINATIONS AND ORIGIN PAIRS WITH HIGHEST CLIENT SCORE


LEGEND
△ Origins for MetroAccess Clients
○ Destinations for MetroAccess Clients
Major Roads
Water
District of Columbia
Counties
MetroAccess data from October 2007
Georgetown University Medical Center
Veteran Affairs Medical Center
Howard University Hospital
Greater Southeast Community Hospital
District of Columbia
KFH GROUP
metro
Community Support Services, Inc.
SEEC of Rockville
ARC of PG County - Sweitzer
Holy Cross Hospital
We Care Adult Services
Prince Georges Community College
N
0
5
10
Miles

# Figure 3-2: BOTTOM TIER (11-20) DESTINATION AND ORIGIN PAIRS WITH HIGHEST CLIENT SCORE


LEGEND
Origins for MetroAccess Clients
Destinations for MetroAccess Clients
Major Roads
Water
District of Columbia
Counties
MetroAccess data from October 2007
Walter Reed Army Medical Center
Providence Hospital
District of Columbia
KFH GROUP
metro
Montgomery College
Revitz House
Rock Creek Foundation for Mental Health, Inc.
Inwood House
Ezras Israel Congregation
Center for the Handicapped
Bethesda National Naval Medical Center
Walter Reed Army Medical Center
Providence Hospital
Virginia Commwealth University - School of Social Work
N
0
5
10
Miles

- Ten of the destinations were located in Montgomery County, with four of that total in the top tier (10 destinations with the highest number of trips).

- Five of the destinations were located in the District of Columbia, with two of that total in the top tier.

- Four of the destinations were located in Prince George's County, with all four in the top tier including the top two destinations.

- One of the destinations was located in Alexandria, which is the only top destination found in the Commonwealth of Virginia.

- No destinations were located in Arlington or Fairfax Counties, or the Cities of Fairfax and Falls Church.

An analysis of the paired origins to these top 20 destinations found the following:

- Eleven of the origins were located in Montgomery County, with five of that total in the top tier.

- Four of the origins were located in the District of Columbia, with two of that total in the top tier.

- Four of the origins were located in Prince George's County, with three of that total in the top tier.

- One of the origins was located in Fairfax County, which is the pairing to the destination at the Virginia Commonwealth University's School of Social Work.

- No origins were located in the Cities of Alexandria, Fairfax and Falls Church, or Arlington County.

Through additional analysis it was also determined that the majority of travel from origin to paired destination within the set of 20 pathways was within the same jurisdiction. There were 16 of the 20 pairings in the same jurisdiction, leaving only four where the origin and destination were in separate jurisdictions, which included:

- An origin in Montgomery County (Calverton) traveled to the destination in Prince George's County (ARC of Prince George's County-Sweitzer).

- An origin in Washington, D.C. traveled to the destination in Montgomery County (Holy Cross Hospital).

- An origin in Montgomery County (Montgomery Village) traveled to the destination in Washington, D.C. (Georgetown University Medical Center).

- An origin in Prince George's County (Temple Hills) traveled to the destination in Washington, D.C. (Walter Reed Army Medical Center).

# Section 4

# Pathway Assessment Methodology

The following section provides two sets of methodologies for assessing the accessibility of a walk path from a specific bus stop location to an origin/destination. The first methodology is a desktop methodology that makes use of available spatial and imagery data in the region to conduct a coarse level assessment of the walk path. The second methodology outlines the necessary steps to plan for, conduct, and document the accessibility of the walk path in the field to provide a more detailed assessment.

## AMERICANS WITH DISABILITIES ACT ACCESSIBLE GUIDELINES

As part of the development of the methodologies, a review of the ADAAG pertaining to an accessible walk path was conducted. The ADAAG were established under the ADA of 1990. The ADAAG for Buildings and Facilities contain requirements for new construction and alterations of facilities by public and private entities. (Note: there are also ADAAG for transportation vehicles; however, in this document, ADAAG refers to those for Buildings and Facilities.) The U.S. Access Board developed and updates the requirements as "guidelines" to serve as a basis for "standards" that are enforced by the Department of Justice (DOJ) and the Department of Transportation (DOT). The ADAAG were initially established in 1991 and updated through 2002.

The ADAAG were updated and combined with the Architectural Barriers Act (ABA) of 1968 (which applies to facilities designed, built, altered, or leased with federal funds) into a single set of requirements (the ADA-ABA Guidelines) published on July 23, 2004. DOT adopted the updated ADA-ABA Guidelines as enforceable standards for transportation facilities in October 2006. DOJ issued notice of intent to adopt the guidelines in June 2008 and is accepting comments through August 18, 2008.

The Public Rights-of-Way (PROW) Guidelines, based on the recommendations of PROW Access Advisory Committee (PROWAC), are currently in draft form. These new guidelines will cover pedestrian access to sidewalks and streets, including crosswalks, curb ramps, street furnishings, pedestrian signals, parking, and other components of public rights-of-way. Initially developed as a supplement, the ADA-ABA Guidelines, and the Revised Draft PROW Guidelines (published in November 2005) are formatted as a stand-alone document. The next step will be the publishing of a Notice of Proposed Rulemaking, which will solicit further public comment on the proposed new guidelines. The final guidelines will need to be adopted by the appropriate federal agencies (i.e., DOJ and DOT) before they become enforceable.

Additional information can be found at:
http://www.access-board.gov/adaag/about/using%20adaag.htm
http://www.access-board.gov/ada-aba/status.htm
http://www.access-board.gov/prowac/

Table 4-1 provides a summary of the main ADAAG guidelines regarding a walk path along the PROW. All of the Access Board Guidelines and Standards can be found through: http://www.access-board.gov/gs.htm. For the purposes of this study, select elements from the ADAAG were used in the field assessment as indicated in Table 4-1.

**Table 4-1**

| Category | Element | Standard for New Construction | Source of Standard | Used in Field Assessment |
|---|---|---|---|---|
| **Walk Path** | | | | |
| | Surface | Stable; Firm; Slip Resistant | ADA-ABA 302.1<br>Draft PROW R301.5 | Yes |
| | Narrowest continuous and unobstructed clear width exclusive of curb | 3 ft min.<br>4 ft min. | ADA-ABA<br>Draft PROW R301.3.1 | Yes |
| | Surface gaps (e.g. space between sidewalk panels, grates) parallel to dominant direction of travel | ½ inch max. | ADA-ABA 302.3<br>Draft PROW R301.7 | Yes |
| | Abrupt vertical changes in elevation | ¼ inch max, additional ¼ inch if beveled 1:2 (50%) max. slope (i.e. ½ inch max. with bevel) | ADA-ABA 303.2-3<br>Draft PROW R301.5 | Yes |
| | Protrusion into the vertical clearance of the pathway (27-80 inches off the ground) | 4 ½ inches max. | ADA-ABA 307.2<br>Draft PROW R401 | Yes |
| | Running slope (parallel to the direction of travel) | 1:20 (5%) max. for most surfaces<br>If steeper, see "Ramps" | ADA-ABA 402 | Yes |
| | Cross slope (perpendicular to the direction of travel) | 1:48 (2%) | ADA-ABA 405.3<br>Draft PROW R406.3 | Yes |

| Category | Element | Standard for New Construction | Source of Standard | Used in Field Assessment |
|---|---|---|---|---|
| **Intersections** | | | | |
| | Presence of a ped xing signal<br>- Is it audible? | Each crosswalk with pedestrian signal indication shall have an accessible pedestrian signal which includes audible and vibrotactile indications of the WALK interval. | Draft PROW R306 | Yes |
| | Length of "walk" and flashing "wait" signal in each direction.<br>- Count down indicator<br>- Walking distance of crosswalk | All pedestrian signal phase timing shall be calculated using a pedestrian walk speed of 3.5 ft per sec. max. The crosswalk distance used in calculating pedestrian signal phase timing shall include the entire length of the crosswalk. | Draft PROW R305.3 | - |
| | If ped xing signal is user activated, is there a clear level space in front of the button that is connected to the path of travel? | 30 inches by 48 inches min.,<br>cross slope 2% max. | Draft PROW R402 | Yes |
| **Medians** | Presence and size of median | Medians and pedestrian refuge islands shall be 6.0 ft min. in direction of travel. | Draft PROW R305.4.1 | - |
| | If there is a median, and the signal requires user activation, is there a button on the median with 30x48 clear space? | 30 inches by 48 inches min.,<br>cross slope 2% max. | Draft PROW R402 | - |
| | Presence of detectable warnings at entry/exit to median | | Draft PROW R305.4.2 | Yes |
| **Curb Ramps (aka curb cuts)** | | | | |
| | Running slope (parallel to the direction of travel) | 1:8 (12.5%) max.<br>1:12 (8.33%) max. | ADA-ABA 405.2<br>Draft PROW R303.2.1.1 | Yes |
| | Cross slope (perpendicular to the direction of travel) | 1:48 (2%) (except mid-block perpendicular ramps can be same as road grade) | ADA-ABA 405.3<br>R303.2.1.3 and R303.2.2.3 | - |

| Category | Element | Standard for New Construction | Source of Standard | Used in Field Assessment |
|---|---|---|---|---|
| | Counter slope (slope down toward bottom of ramp from adjacent street). | 1:20 (5%) max. | ADA-ABA 406.2<br>Draft PROW R303.3.5 | |
| | Presence of curb flares (sloped sides of ramp)<br>Slope of curb flares parallel to the curb. | 1:10 (10%) max. (Only required if no landing is provided at top and then no more than 1:12 (8.33%) max.) | ADA-ABA 406.3<br>ADA-ABA 406.4 | - |
| | Presence of landing at the top of the ramp.<br>Size of landing. | Ramp width min.,<br>36 inches deep min.;<br>48 inches deep min. | ADA-ABA 406.4<br>Draft PROW Advisory R301.3.1<br>R303.2.2.3,<br>R303.3.6 | Yes |
| | If parallel to direction of travel, is it within the crosswalk? | Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides | ADA-ABA 406.5<br>Draft PROW R303.3.6 | - |
| | If diagonal (single ramp in corner), is there a landing area at least 48″ deep contained within marked crosswalk? | The bottom of diagonal curb ramps shall have a clear space 48 in. min. outside active traffic lanes of the roadway | ADA-ABA 406.6 | - |
| | If curb ramps are in a median/island, is there a landing area at the top of both ramps at least 48″ long (parallel to crossing) and 36″ wide? | 48 inches deep by 36 inches wide min. | ADA-ABA 406.7<br>Draft PROW R303.3.6 | - |
| | If a landing area is needed, is it level? | 2% grade max. running/cross slopes (except mid-block can be same as road grade) | Draft PROW R303.2.1.3 and R303.2.2.3 | - |
| | Are the grade breaks perpendicular? | Grade breaks at top and bottom of perpendicular curb ramps shall be perpendicular to ramp run | Draft PROW R303.3.4 | - |
| | Are the grade breaks flush? | Surface slopes that meet at grade breaks shall be flush | Draft PROW R303.3.4 | - |
| | Does the ramp have detectable warnings (truncated domes?) | | ADA-ABA 705<br>Draft PROW R303.3.2 | Yes |

| Category | Element | Standard for New Construction | Source of Standard | Used in Field Assessment |
|---|---|---|---|---|
| **Crosswalks** | Is there a marked crosswalk? | | | Yes |
| | Width | 6 feet min. | Draft PROW R305.2.1 | - |

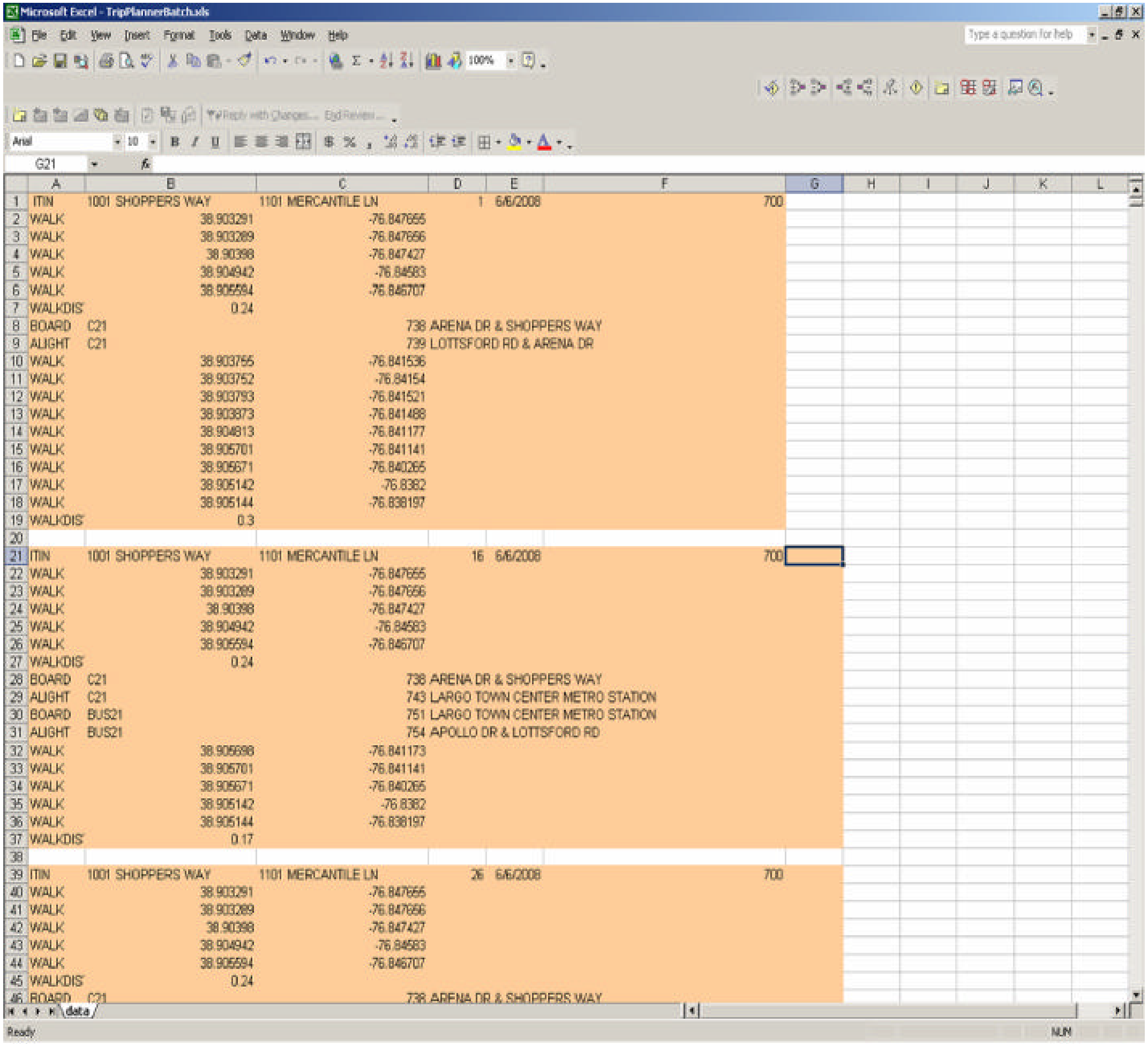
## DESKTOP METHODOLOGY

As a part of the multi-pronged approach to develop a methodology for determining the accessibility of pathways, the desktop assessment focused on using available data (Section 2, Table 2-2) such as the sidewalk and curb ramp inventory, the bus stop inventory, and other pedestrian infrastructure inventories from the local jurisdictions. As described in Section 2, the Maryland State Highway Administration (SHA) has coverage limited to the state highway system for Montgomery and Prince George's Counties. The SHA data has information about sidewalks, ramps, vertical elevation, median treatments, bus stops, and sidewalk obstructions. This data supplemented the data from individual jurisdictions, especially for the portions of pathways along sections of State highway system and cases where the data from the jurisdictions does not have coverage. Table 2-2 provided a matrix of the spatial data that was available from the jurisdictions. In addition, the desktop analysis is supplemented by ortho and oblique aerial imagery, where available. The ability to systematically perform a pathway assessment from a desktop environment, even at a macro level, can prove to be a valuable tool identifying major infrastructure deficiencies in accessibility.

### Approach

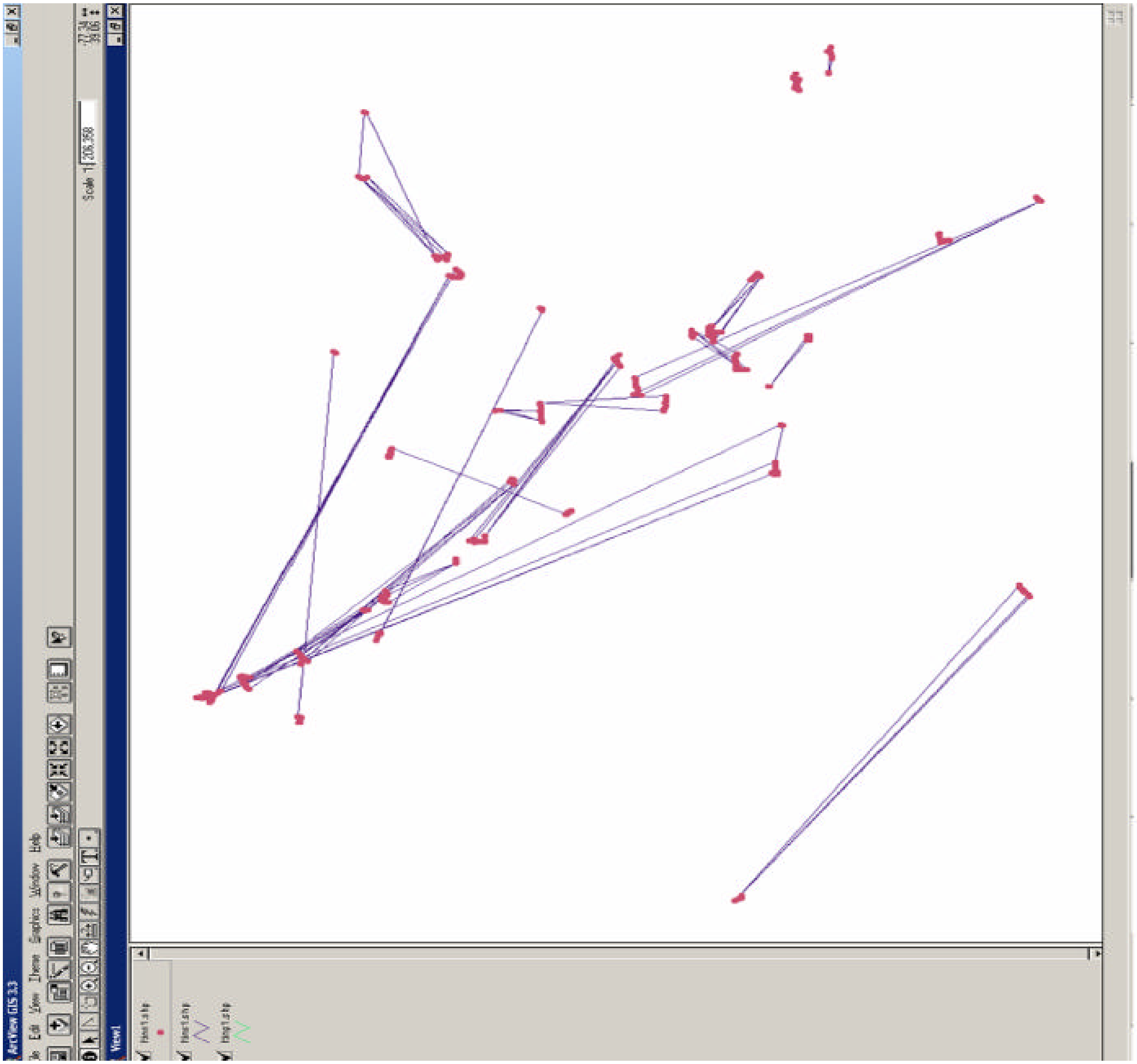
The access and egress pathways were generated from a batch process through Metro's Trip Planner based on the top 20 origin and destination pairs from the Cluster Analysis in Section 3. The batch process produced an output in a text file format. The text file was reformatted into a Microsoft Excel table (as shown in Figure 4-1) and then converted into a geo-spatial database to display the pathways in GIS. A software program was written in ArcView scripting language to create shapefiles from the pathway coordinates, while preserving attribute information pertaining to walking distance, transit times, time-of-day information, and route information for each itinerary generated by the Trip Planner. The script also displayed the transit portions of the itinerary with a straight line that must be removed by post-processing the shapefiles (Figure 4-2). One limitation to using Metro's Trip Planner in generating the walking path to and from the bus stop is the lack of any spatial or descriptive information on exact locations of the bus stops in the region. The Trip Planner currently references the

## Figure 4-1
## TRIP PLANNER BATCH FILE IN EXCEL FORMAT


Microsoft Excel - TripPlannerBatch.xls
File Edit View Insert Format Tools Data Window Help
Type a question for help
100%
Reply with Changes... End Review...
Arial
10
G21
data
Ready
NUM

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | ITIN | 1001 SHOPPERS WAY | 1101 MERCANTILE LN | 1 | 6/6/2008 | 700 |
| 2 | WALK | 38.903291 | -76.847655 | | | |
| 3 | WALK | 38.903289 | -76.847656 | | | |
| 4 | WALK | 38.90398 | -76.847427 | | | |
| 5 | WALK | 38.904942 | -76.84583 | | | |
| 6 | WALK | 38.905594 | -76.846707 | | | |
| 7 | WALKDIS | 0.24 | | | | |
| 8 | BOARD | C21 | | 738 | ARENA DR & SHOPPERS WAY | |
| 9 | ALIGHT | C21 | | 739 | LOTTSFORD RD & ARENA DR | |
| 10 | WALK | 38.903755 | -76.841536 | | | |
| 11 | WALK | 38.903752 | -76.84154 | | | |
| 12 | WALK | 38.903793 | -76.841521 | | | |
| 13 | WALK | 38.903873 | -76.841488 | | | |
| 14 | WALK | 38.904813 | -76.841177 | | | |
| 15 | WALK | 38.905701 | -76.841141 | | | |
| 16 | WALK | 38.905671 | -76.840265 | | | |
| 17 | WALK | 38.905142 | -76.8382 | | | |
| 18 | WALK | 38.905144 | -76.838197 | | | |
| 19 | WALKDIS | 0.3 | | | | |
| 20 | | | | | | |
| 21 | ITIN | 1001 SHOPPERS WAY | 1101 MERCANTILE LN | 16 | 6/6/2008 | 700 |
| 22 | WALK | 38.903291 | -76.847655 | | | |
| 23 | WALK | 38.903289 | -76.847656 | | | |
| 24 | WALK | 38.90398 | -76.847427 | | | |
| 25 | WALK | 38.904942 | -76.84583 | | | |
| 26 | WALK | 38.905594 | -76.846707 | | | |
| 27 | WALKDIS | 0.24 | | | | |
| 28 | BOARD | C21 | | 738 | ARENA DR & SHOPPERS WAY | |
| 29 | ALIGHT | C21 | | 743 | LARGO TOWN CENTER METRO STATION | |
| 30 | BOARD | BUS21 | | 751 | LARGO TOWN CENTER METRO STATION | |
| 31 | ALIGHT | BUS21 | | 754 | APOLLO DR & LOTTSFORD RD | |
| 32 | WALK | 38.905698 | -76.841173 | | | |
| 33 | WALK | 38.905701 | -76.841141 | | | |
| 34 | WALK | 38.905671 | -76.840265 | | | |
| 35 | WALK | 38.905142 | -76.8382 | | | |
| 36 | WALK | 38.905144 | -76.838197 | | | |
| 37 | WALKDIS | 0.17 | | | | |
| 38 | | | | | | |
| 39 | ITIN | 1001 SHOPPERS WAY | 1101 MERCANTILE LN | 26 | 6/6/2008 | 700 |
| 40 | WALK | 38.903291 | -76.847655 | | | |
| 41 | WALK | 38.903289 | -76.847656 | | | |
| 42 | WALK | 38.90398 | -76.847427 | | | |
| 43 | WALK | 38.904942 | -76.84583 | | | |
| 44 | WALK | 38.905594 | -76.846707 | | | |
| 45 | WALKDIS | 0.24 | | | | |
| 46 | BOARD | C21 | | 738 | ARENA DR & SHOPPERS WAY | |

**Figure 4-2: ARCVIEW Routing**



location of a bus stop based on the nearest intersection. One of the problems with referencing the intersection as the bus stop location is that it is not easy to determine which side of the street the bus will be stopping on. The walking path will differ depending on which side of the street the bus stop is located on. In addition, some bus stops are located mid-block, meaning the bus stop is not near any intersection.

Itineraries were initially screened based on the most frequently requested time of day for MetroAccess trips to the destination. The requested time was categorized into one of three time periods according to the most similar Trip Planner scheduled departure time of 7:00 a.m., 1:00 p.m., or 5:00 p.m. (Table 4-2).

**Table 4-2**
**Most Frequently Requested Time of Day MetroAccess Trip**

| Trip leaves between | Peak/Off Peak | Trip Planner Scheduled Departure Time |
|---|---|---|
| 6:00 a.m.-9:59 a.m. | Peak | 7:00 a.m. |
| 10:00 a.m.-2:59 p.m. | Off Peak | 1:00 p.m. |
| 3:00 p.m.-6:59 p.m. | Peak | 5:00 p.m. |
| 7:00 p.m.-12:00 midnight | Off Peak | 1:00 p.m. |

These itineraries were then ranked in ascending order by total trip time. The itinerary with the lowest total trip time was selected as the preferred itinerary to be analyzed for accessibility along the access and egress pathways. Ranking the itineraries is important. In case the pathway for preferred itinerary is inaccessible, or the transit route is obsolete due to route alignment changes, then the next ranked itinerary can be analyzed for accessibility.

A comprehensive ArcMap project document containing jurisdiction data, along with aerial photography was created as a basemap for analysis. The concept of spatial bookmarking was utilized to assess the pathways. Spatial bookmarks allow the user to store and save the view extent of pathway, which can be saved in a list of bookmarks and can be viewed from the list as needed. Bookmarks are named with their corresponding itinerary names for easy recognition and access. Each Trip Planner generated pathway was assessed based on the availability of key elements along the pathway such as sidewalks, curb ramps, crosswalks, and median treatments. The presence of these elements along the pathway can be used to target which pathways warrant a field assessment to determine an accessible pathway. Conversely, a desk analysis can potentially eliminate pathways as being inaccessible because of the lack of key elements along the pathway.

Along with the jurisdiction data, oblique aerial photography (www.maps.live.com) was used for a better visualization of pathways. Figure 4-3 provides an example of the level of quality and resolution from the oblique view. Oblique views of the pathways from different directions can help identify the presence of sidewalks and obstructions, which might otherwise be difficult to ascertain from more conventional ortho-imagery.

In addition to the pathway conditions, the bus stop condition is another critical piece used to determine the feasibility of the Trip Planner itinerary. The bus stop condition utilizes data gathered for the bus stop inventory for the region. A bus stop is deemed accessible if the following criteria are met: there is adequate space at a bus pad to deploy a wheelchair lift; no obstructions are present in the sidewalk leading to the bus pad; and whether the bus shelter is accessible. Even though the pathway and bus stop condition have been analyzed separately they are treated as part of a unified analysis when considering accessibility of the trip (if a pathway is inaccessible it doesn't matter whether the bus stop condition is accessible and vice versa).

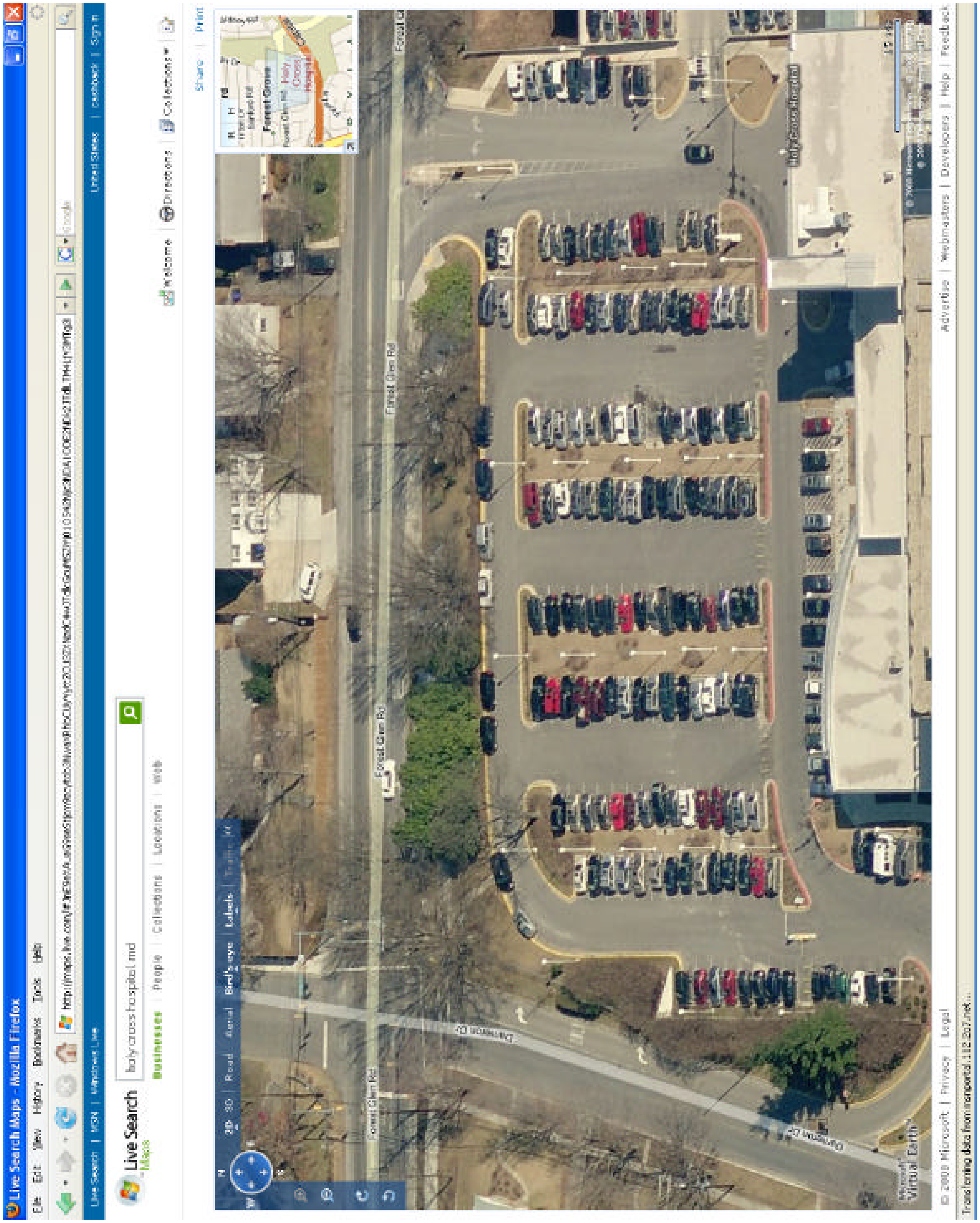
## FIELD ASSESSMENT METHODOLOGY

While the desktop methodology allows for an assessment on a more macro level, a field survey will allow for a more detailed analysis of the accessibility of a pedestrian pathway. In addition, external factors affecting the conditions of the pedestrian environment make it difficult to identify potential pathway accessibility issues without a field assessment. Four out of the five systems interviewed conduct field surveys to determine the accessibility of a walk path as part of their conditional eligibility process for their complementary ADA paratransit service.

### Planning

In addition to using the batch file generated by WMATA's Trip Planner, the top 20 origin and destination pairs were processed through WMATA's web-based trip planner application. The reason the web-based trip planner was also used was because the batch file provided only spatial data regarding the routing of the walk path, making it difficult to ascertain the exact route of the walking path. The web-based trip planner was able to provide turn-by-turn text description of the walking path between the bus stop and the origin/destination.

# Figure 4-3
# EXAMPLE OF OBLIQUE IMAGERY


Live Search Maps - Mozilla Firefox
File Edit View History Bookmarks Tools Help
Live Search | MSN | Windows Live
United States | cashback | Sign in
Live Search Maps
holy cross hospital md
Businesses People Collections Locations Web
Welcome Directions Collections
Share | Print
2D 3D Road Aerial Bird's eye Labels Traffic
Forest Glen Rd
Dameron Dr
Holy Cross Hospital
Forest Grove
Microsoft Virtual Earth
© 2008 Microsoft | Privacy | Legal
Advertise | Webmasters | Developers | Help | Feedback

For each trip to be reviewed and assessed, the information generated by the trip planner along with a map of the preferred walking path was printed out and grouped. These trips were then grouped with other trips in the general area to maximize the efficiency in the field. For example, all trip ends in Gaithersburg and Rockville were grouped together. This grouping was accomplished by mapping the trip ends in GIS. For each pathway to be assessed, a map of the walk path was printed out.

At this point in the planning process, the walk path has not been broken into various segments. The segments will be determined in the field during the field assessment.

The equipment used in the field includes a measuring wheel (to measure pathway widths), an inclinometer (to measure percent of incline), a digital camera, and a Trimble handheld GPS device. The Trimble handheld unit is used to log the longitude and latitude of the pathway and input the assessment information.

## Field Assessment

### *Step 1 – Location Origin/Destination*

Find trip origin or destination.

### *Step 2 – Locate Bus Stop*

Locate the intersection referenced by the Trip Planner, and determine the appropriate bus stop based on the direction of travel. The Trip Planner does not provide specific bus stop location information, but rather intersections. As such, it may be necessary at times to refer to the bus route to determine which side of the street to board the bus.

### *Step 3 – Observe for Other Bus Stops*

Observe if there are bus stops that are served by the same route closer to the trip end. If so, use the closer bus stop. In some cases, there are new bus stops and stops that are located on the property of the destination that may better serve the trip/customer.

### *Step 4 – Determine Walking Path*

Once the best bus stop location has been identified, determine if the best and most appropriate walk path to the trip end. This walk path may be different than the walk path suggested by the Trip Planner.

### *Step 5 – Assess Walking Path*

If an alternative walk path was identified from Step 4, assess this alternative walk path. Otherwise assess the walk path as outlined in the Trip Planner. Each pathway assessment can include multiple segments that make up a complete trip. The assessment of the walk path is from the bus stop location to the curb or entrance of the trip end for that leg of the trip. The first segment of the walk path begins at the bus stop location. Subsequent segments begin when there is a change in the direction of travel that is onto another street, an intersection crossing, or parking lot crossing. If there is a transfer between routes requiring the passenger to travel between bus stop locations, the walk path between the two stops is also assessed.

The walk paths are assessed based on the guidelines in Table 4-1 for the following elements:

- Presence of pathway
- Pathway width
- Pathway incline/cross slope
- Pathway vertical elevation
- Protrusions
- Obstructions
- Curb ramps
- Marked Crosswalks
- Pedestrian signals
- Traffic controls
- Wheelchair ramps

Appendix A provides an annotated data dictionary of the information that was surveyed. This information about the walking path for each leg of the trip is recorded into the Trimble handheld unit. Digital photos are taken of any identified barriers or obstructions.

### *Step 6 - Post-Process*

The information recorded in the handheld GPS Trimble unit is downloaded and exported as a shapefile. The shapefile is then brought into a GIS environment and layered over the bus stop database and ortho-images where the line segments are processed and reviewed for errors and accuracy. Each walk path (including segments) is stored in GIS as its own polyline shapefile. A unique identification number is used to identify each leg of the trip so that walk paths for the origin leg of the trip can be easily paired with the destination leg of the trip.

Many locations conducting accessible pathway assessments for their clients currently store their information in static, text environment such as Excel. By storing the data in a GIS environment, all of the walk paths can be mapped and visually displayed which allows staff to easily identify segments that are already assessed. In addition, since all of the information collected about each segment for each walk path is stored in an attribute table and associated with that leg of the trip, segments with accessibility issues can easily be displayed.

The photos of obstructions taken for each pathway are cataloged and stored in a master folder and linked to the segments.

# Section 5

# Improvement Prioritization

## INTRODUCTION

This task provides a prioritization of the recommended pathway improvements for the top 20 MetroAccess trip pairs identified in the Cluster Analysis. The goal of this prioritization is to maximize the impacts of the improvements by determining which trips would potentially benefit the most by making the walking paths between the bus stop and the origin and/or destination accessible. In other words, an attempt was made to target locations where a minimal amount or ease of improvements would yield the greatest potential for increasing fixed-route usage and at the same time increase the effectiveness and efficiency of MetroAccess. This was accomplished by using data that was available. The criteria used in this prioritization process include:

- Number of unique clients
- Total number of trips
- Number and complexity of improvements
- Field assessments
- Condition of associated bus stop

Ideally, having information on client age and type of disability would help to further target where best to make the improvements, but was understandably not available because of the sensitive nature of the information. However, the criteria used in this prioritization are successful in identifying locations to best target the improvements. Each of the criteria and its applications are discussed below.

## PRIORITIZATION

### Total Unique Client Count Ranking

For this criterion, the number of individual clients for each trip pair was sorted, scored, and ranked. The 20-trip pairs were first placed in ascending order from the smallest to the greatest number of individual clients. Once sorted, the trip pairs were assigned a numeric score based on the number of unique clients, with the highest score (1) given to the trip pair with the fewest number of unique clients, and a lower score to trip pairs with a greater number of unique clients.

Giving a higher priority score to trip pairs serving fewer unique clients may seem counter intuitive. But the rationale for this is that trips with greater numbers of unduplicated clients are likely quite productive MetroAccess trips (measured as passenger trips per revenue hour), since many such trips are grouped trips. Trips that serve fewer numbers of clients are less likely to be grouped and productive MetroAccess trips are therefore more likely to be less cost effective on MetroAccess.

### Total Trip Count Ranking

This criterion is based on the total number of requested trips (as an indicator of trip activity) between the origin and destination. For each of the 20 trip pairs, the total number of requested trips was sorted, scored, and ranked. First, the 20 trips were sorted into descending order from the most number of trip requests to the fewest number of trip requests. Once sorted in descending order, the trip pairs were given a score between 1 and 20, with the score of one going to the trip pair with the greatest amount of trip requests to that destination. The next trip pair in the sequence was then given the next numerical value in order. Similar to the "Total Unique Client Count Ranking", in cases where there is an identical number of trip requests, those trip pairs were given the same numerical score. This numeric score is then used to rank each of the trip pairs. This ranking combined with the "Total Unique Client Count Ranking" will enable us to identify locations where many trips are made by just a few clients, allowing the pathway improvements to have a greater impact on overall service efficiency.

### Total Improvement Ranking

For this criterion, the type and complexity of the improvements for each walk path were scored and ranked. Walkways with no problems received a score of 0, while walkways with problems received scores of 2 or 5 depending on the complexity of the problem. For example, a walkway that was obstructed by a utility pole would receive a higher score than a walkway that was obstructed by encroaching landscape such as bushes. For each trip pair, the following elements were scored:

- Walkway
    - Presence (yes = 0, none = 5)
    - Width (> 3 feet = 0, < 3 feet = 2, none = 5)
    - Surface problem (none = 0, yes = 2)
    - Vertical elevation (none = 0, > ¼” = 2)
    - Gaps (none = 0, > ½” = 2)
    - Slope (none = 0, > 5 degrees = 5)
    - Cross Slope (none = 0, > 2 degrees = 5)

- Pedestrian Signal (at intersection or pedestrian crossing)
    - Presence (yes = 0, none = 2)
    - Accessible (yes = 0, none = 2)

- Obstruction
    - Presence (none = 0, non-permanent = 2, permanent = 5)

- Curb Ramps
    - Presence (yes = 0, none = 2)
    - Problem with ramp (none = 0, yes = 2)

- Crosswalk (at intersection or pedestrian crossing)
    - Presence (yes = 0, none = 2)

Upon scoring each of the above elements, each trip pair was ranked based on the overall score. Trips with lower scores were ranked higher than trips with higher total scores. The objective of this approach is to identify locations where improvements can be made with the least amount of effort and resources, verses locations where much greater effort will be required to make the improvement(s).

### Field Assessments Ranking (Compliant-Functional, Non-Compliant-Functional, Non-Compliant-Non-Functional)

For this criterion, the Field Assessments of the walk paths for each segment in the 20 origin/destination pairings were analyzed, then sorted and ranked. Each trip pairing is comprised of a certain number of segments, each of which was designated as being Compliant-Functional, Non-Compliant-Functional, Non-Compliant-Non-Functional

For the purposes of this ranking, the number of segments for each pairing was totaled within these three distinct categories. Once the categorical totals were determined, the trip pairs were then sorted based on the total number of Non-Compliant-Non-Functional segments from the highest to the lowest. In the cases where pairs had the same number of Non-Compliant-Non-Functional segments, the Non-Compliant-Functional category was used as the tiebreaker, in that the pairing with more Non-Compliant-Functional segments was placed higher on the list. In instances where the Non-Compliant-Non-Functional and Non-Compliant-Functional segment totals were the same, the trip pair with more trip activity was moved up on the list.

Once the list was finalized, each of the origin/destination pairings are ranked so that the trip pairs with the most number of Non-Compliant-Non-Functional and Non-Compliant-Functional segments are at the top of the ranking. This process can be seen in Table 5-1.

### Bus Stop Scoring

For this criterion, the accessibility of the bus stops that served the origin and the destination of the 20 trip pairs was evaluated and scored. The criteria used to determine if a bus stop was accessible or not included: the presence of a 5x8 foot landing pad on a solid surface without obstruction and, if applicable, a shelter able to provide complete cover for all potential passengers and is free of any potential obstructions. Not included is the sidewalk connection to the bus stop because that is already assessed during the field survey of the walk path. If a bus stop possessed the aforementioned criteria, then it was deemed accessible and was given a score of zero. However, if any of the criteria was not met, then the bus stop was determined inaccessible and given a score of ten. For each origin/destination pairing, the scoring of the bus stops used in the trip were totaled and denoted in the “Bus Stop Scoring” column.

## RESULTS

This prioritization presents an overall identification as to which origin/destination pairings should be initially targeted for improvements. The prioritization was determined by summing the rankings and/or scorings of the five criteria described above (Total Client Count Ranking, Total Trip Count, Total Improvements Ranking, Field Assessments Ranking, and Bus Stop Scoring). Once the cumulative total was determined for each of the 20 origin/destination pairings, the pairings were sorted with the lowest sum having the highest “Priority Ranking” to the highest sum having the lowest Priority Ranking. In the case of an equal sum, the pairing with the highest destination trip activity was assigned the higher ranking. As can be seen in Table 5-2, the trip pair with the highest priority ranking through this process is labeled Trip #12, where the origin is a residential location and therefore not labeled because of client privacy, and the destination is Providence Hospital. The pair ranked as second priority is labeled Trip #15, where the origin is Holy Cross Hospital and the destination, the Inwood House.

## Table 5-1: Field Assessment Ranking

| Priority Ranking | Trip Portion | Total Segments | Compliant Functional Segments | Non-Compliant Functional Segments | Non-Compliant Non-Functional Segments |
|---|---|---|---|---|---|
| **1** | **#13 Origin/Destination Pairing: Virginia Commonwealth University - School of Social Work** | | | | |
| | Origin | 6 | 1 | 4 | **1** |
| | Destination | 5 | 2 | 1 | **2** |
| | *Totals* | *11* | *3* | *5* | ***3*** |
| **2** | **#3 Origin/Destination Pairing: Supported Employment Enterprise Corporation of Rockville** | | | | |
| | Origin | 13 | 7 | 5 | **1** |
| | Trip Transfer | 3 | 3 | 0 | **0** |
| | Destination | 6 | 3 | 2 | **1** |
| | *Totals* | *22* | *13* | *7* | ***2*** |
| **3** | **#9 Origin/Destination Pairing: Greater Southeast Community Hospital** | | | | |
| | Origin | 6 | 1 | 4 | **1** |
| | Destination | 4 | 2 | 2 | **0** |
| | *Totals* | *10* | *3* | *6* | ***1*** |
| **4** | **#7 Origin/Destination Pairing: Community Support Services, Inc.** | | | | |
| | Origin | 4 | 0 | 3 | **1** |
| | Destination | 3 | 1 | 2 | **0** |
| | *Totals* | *7* | *1* | *5* | ***1*** |
| **5** | **#20 Origin/Destination Pairing: Center for the Handicapped** | | | | |
| | Origin | 5 | 1 | 3 | **1** |
| | Destination | 4 | 3 | 1 | **0** |
| | *Totals* | *9* | *4* | *4* | ***1*** |
| **6** | **#5 Origin/Destination Pairing: Holy Cross Hospital** | | | | |
| | Origin | 3 | 2 | 1 | **0** |
| | Destination | 5 | 2 | 2 | **1** |
| | *Totals* | *8* | *4* | *3* | ***1*** |
| **7** | **#6 Origin/Destination Pairing: Georgetown University Medical Center** | | | | |
| | Origin | 2 | 1 | 0 | **1** |
| | Destination | 4 | 1 | 3 | **0** |
| | *Totals* | *6* | *2* | *3* | ***1*** |
| **8** | **#17 Origin/Destination Pairing: Walter Reed Army Medical Center** | | | | |
| | Origin | 4 | 2 | 1 | **1** |
| | Destination | 3 | 1 | 2 | **0** |
| | *Totals* | *7* | *3* | *3* | ***1*** |
| **9** | **#19 Origin/Destination Pairing: Revitz House** | | | | |
| | Origin | 5 | 4 | 1 | **0** |
| | Destination | 6 | 3 | 2 | **1** |
| | *Totals* | *11* | *7* | *3* | ***1*** |
| **10** | **#1 Origin/Destination Pairing: We Care Adult Services** | | | | |
| | Origin | 2 | 1 | 0 | **1** |
| | Destination | 4 | 2 | 2 | **0** |
| | *Totals* | *6* | *3* | *2* | ***1*** |
| **11** | **#11 Origin/Destination Pairing: Montgomery College** | | | | |
| | Origin | 8 | 5 | 2 | **1** |
| | Destination | 2 | 2 | 0 | **0** |
| | *Totals* | *10* | *7* | *2* | ***1*** |

## Table 5-1: Field Assessment Ranking

| **Priority Ranking** | **Trip Portion** | **Total Segments** | **Compliant Functional Segments** | **Non-Compliant Functional Segments** | **Non-Compliant Non-Functional Segments** |
|---|---|---|---|---|---|
| **12** | **#16 Origin/Destination Pairing: Rock Creek Foundation for Mental Health, Inc.** | | | | |
| | Origin | 3 | 1 | 1 | **1** |
| | Destination | 3 | 3 | 0 | **0** |
| | *Totals* | *6* | *4* | *1* | ***1*** |
| **13** | **#2 Origin/Destination Pairing: ARC of Prince Georges County - Sweitzer** | | | | |
| | Origin | 6 | 1 | 5 | **0** |
| | Destination | 5 | 2 | 3 | **0** |
| | *Totals* | *11* | *3* | *8* | ***0*** |
| **14** | **#18 Origin/Destination Pairing: Bethesda National Naval Medical Center** | | | | |
| | Origin | 8 | 2 | 6 | **0** |
| | Destination | 4 | 4 | 0 | **0** |
| | *Totals* | *12* | *6* | *6* | ***0*** |
| **15** | **#14 Origin/Destination Pairing: Ezra's Israel Congregation** | | | | |
| | Origin | 3 | 3 | 0 | **0** |
| | Destination | 6 | 3 | 3 | **0** |
| | *Totals* | *9* | *6* | *3* | ***0*** |
| **16** | **#15 Origin/Destination Pairing: Inwood House** | | | | |
| | Origin | 2 | 1 | 1 | **0** |
| | Destination | 5 | 4 | 1 | **0** |
| | *Totals* | *7* | *5* | *2* | ***0*** |
| **17** | **#4 Origin/Destination Pairing: Veteran Affairs Medical Center** | | | | |
| | Origin | 3 | 2 | 1 | **0** |
| | Destination | 1 | 1 | 0 | **0** |
| | *Totals* | *4* | *3* | *1* | ***0*** |
| **18** | **#8 Origin/Destination Pairing: Prince Georges Community College** | | | | |
| | Origin | 3 | 2 | 1 | **0** |
| | Destination | 5 | 5 | 0 | **0** |
| | *Totals* | *8* | *7* | *1* | ***0*** |
| **19** | **#10 Origin/Destination Pairing: Howard University Hospital** | | | | |
| | Origin | 2 | 2 | 0 | **0** |
| | Destination | 2 | 1 | 1 | **0** |
| | *Totals* | *4* | *3* | *1* | ***0*** |
| **20** | **#12 Origin/Destination Pairing: Providence Hospital** | | | | |
| | Origin | 1 | 1 | 0 | **0** |
| | Destination | 1 | 1 | 0 | **0** |
| | *Totals* | *2* | *2* | *0* | ***0*** |

**Prioritization was determined by:**

1. Providing the Origin/Destination Pairing with the highest "Non-Compliant/Non-Functional" total the highest prioritization.
2. In the case of a tie in Step 1's total, the Origin/Destination Pairing with the highest 'Non-Compatible/Functional' total received a higher prioritization.
3. In the case of a tie in Step 2's total, the Origin/Destination Pairing with the highest trip activity received a higher prioritization.

## Table 5-2: Prioritization of Locations for Improvements

| Priority Ranking | Pairing Trip Number | Origin | Destination | Total Unique Client Count Score | Total Trip Count Rank | Total Improvements Rank | Total Field Assessment Rank | Total Bus Stop Score | Total Score* | Conditional Exemption** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12 | Client Home | Providence Hospital | 4 | 12 | 1 | 1 | 0 | **18** | **-** |
| 2 | 15 | Holy Cross Home Services | Inwood House | 3 | 5 | 6 | 5 | 0 | **19** | **-** |
| 3 | 10 | Client Home | Howard University Hospital | 2 | 14 | 2 | 2 | 0 | **20** | **-** |
| 4 | 4 | Client Home | Veteran Affairs Medical Center | 1 | 6 | 3 | 4 | 10 | **24** | **-** |
| 5 | 11 | Client Home | Montgomery College | 1 | 7 | 11 | 10 | 0 | **29** | **-** |
| 6 | 5 | Client Home | Holy Cross Hospital | 1 | 9 | 9 | 15 | 0 | **34** | **-** |
| 7 | 18 | Client Home | Bethesda National Naval Medical Center | 1 | 11 | 5 | 7 | 10 | **34** | **-** |
| 8 | 19 | Client Home | Revitz House | 1 | 10 | 12 | 12 | 0 | **35** | **-** |
| 9 | 8 | Client Home | Prince George's Community College | 1 | 8 | 4 | 3 | 20 | **36** | **-** |
| 10 | 14 | Client Home | Ezra's Israel Congregation | 2 | 3 | 15 | 6 | 10 | **36** | **-** |
| 11 | 16 | Client Home | Rock Creek Foundation for Mental Health | 1 | 11 | 7 | 9 | 10 | **38** | **x** |
| 12 | 6 | Client Home | Georgetown University Medical Center | 1 | 8 | 8 | 14 | 10 | **41** | **-** |
| 13 | 17 | Client Home | Walter Reed Army Medical Center | 1 | 11 | 10 | 13 | 10 | **45** | **-** |
| 14 | 2 | Client Home | ARC of Prince George's County | 3 | 1 | 16 | 8 | 20 | **48** | **x** |
| 15 | 1 | Golden Corral | We Care Adult Services | 5 | 2 | 14 | 11 | 20 | **52** | **-** |
| 16 | 3 | Client Home | SEEC of Rockville | 2 | 4 | 20 | 19 | 10 | **55** | **-** |
| 17 | 7 | Client Home | Community Support Services | 1 | 11 | 17 | 17 | 10 | **56** | **-** |
| 18 | 9 | Client Home | Greater Southeast Community Hospital | 1 | 13 | 18 | 18 | 10 | **60** | **-** |
| 19 | 20 | Client Home | Center for the Handicapped | 1 | 11 | 13 | 16 | 20 | **61** | **-** |
| 20 | 13 | Client Home | Virginia Commonwealth Univ.-School of Social Work | 1 | 9 | 19 | 20 | 20 | **69** | **-** |

* Sum of the 'Total Unique Client Count Score', 'Total Trip Count Rank', 'Total Improvements Rank', ' Total Field Assessment Rank' and "Total Bus Stop Score' columns.

** Identifies potential locations where improvements may possibly be conditionally exempt based on field observations; only locations where there were client activity at the time of the survey were the observations documented.  Further analysis will be required for a more accurate determination.

The trip pairs with the highest priority have one or more of the following attributes:

- Trips with minor to no pathway accessibility problems,
- Trips with a high level of activity produced by few clients,
- Accessible bus stops at either one or both legs of the trip

For example, the reason Trip #12 – Providence Hospital was ranked at the top was because the walk paths on both legs of the trip - between the bus stop and origin (which is the unnamed residential location), and the bus stop and destination - are accessible and require no improvements, while the second ranked Trip #15 – between Holy Cross Hospital and Inwood House has a possible slope problem on the origin end of the trip and only a minor curb ramp compliance problem on the destination end of the trip. Otherwise from an infrastructure standpoint, these trips could be mad via fixed-route.

Conversely, trip pairs listed at the bottom of the rankings are have one or more of the following attributes:

- Trips with major pathway accessibility problems
- Grouped trips with lower levels of trip activity
- Inaccessible bus stops at either one or both legs of the trip

For example, the trip pair labeled Trip #13 – with an unnamed residential origin and the destination at Virginia Commonwealth University – School of Social Work was ranked at the bottom due to a lower level of activity, combined with a missing walkway and curb ramp problems on the origin leg of the trip, and curb ramp problems on the destination end of the trip. In addition, the bus stop serving both legs of the trip is inaccessible.

## Conditional Exemption

The prioritization process was based primarily on the level of MetroAccess client usage and the pedestrian environment between the bus stop and the origin and destination. Making the walk paths between the bus stop and origin and destination accessible provides the opportunity for increased fixed-route use by persons with disabilities, including potentially some MetroAccess clients. However, walkway accessibility needs can vary greatly between individuals, and therefore it may be more appropriate for some clients to use MetroAccess rather than the fixed-route service.Though not in the scope of work, the consultant team felt the process would benefit from identifying possible trip pairs where improvements would not make much of a difference for MetroAccess clients making this trip on fixed-route due to client disability. Ideally, information on client age and disability would help to better identify potential locations where improvements may not yield many, if any, fixed-route trips. There were two trips where the survey team observed client activity (boarding or deboarding the MetroAccess vehicle) during the field assessment that could suggest this situation. If no activity was observed, then nothing was documented and a hyphen (-) was placed in the Conditional Exemption column in Table 5-2. For trip pairs that were identified as possible conditional exempt locations, an “x” is placed in the Conditional Exemption column in Table 5-2.

# Section 6

# Findings

## POTENTIAL ISSUES

The ability to leverage existing inventory data and aerial imagery can be a useful tool in assessing the accessibility of a pathway. This study examined the concept of developing a method to conduct pathway assessments in a GIS environment and in the field. For the GIS environment, this involved applying available datasets regarding the pedestrian environment and the bus stop inventory data to the walk paths generated by Metro's Trip Planner. Metro's Trip Planner was the "backbone" for this process because it had the ability to batch process multiple trips and generate spatial information on the walk paths for the 20 trips in this study.

The following summarizes some of the issues encountered during the process of conducting these pathway assessments using existing data, aerial imagery, and Metro's Trip Planner.

- Trip Planner only references intersections and not bus stop locations
  - Unable to identify mid-block bus stop locations
  - Unable to identify bus stops off-street bus stop locations
  - Optimal bus stop could be overlooked
  - Makes the walk path distance inaccurate
  - Unable to indicate which side of the road the suggested bus stop is on

- Trip Planner walk path does not follow the street center line files

- Trip Planner only provides walk path along public right-of-way
  - Does not handle parking lots well

- Major facilities such as hospitals and colleges may have multiple walk path options
- Some itineraries from the Trip Planner do not provide spatial information (no nodes) / walking path
- Parameters do not always generate the most efficient or effective walk path
- Walk path distance not accurate because the Trip Planner does not reference bus stop locations
- Existing spatial databases are limited in coverage and detail
- Aerial imagery with pictometry provides a good supplement to existing datasets but can be out dated
- Conditional information on pedestrian infrastructure cannot be ascertained from aerial imagery or existing databases

It should be noted that the development of Metro's Trip Planner was developed to provide the public with information about what routes could be utilized for their trips and general information regarding the walk path. For that purpose, the Trip Planner is quite useful. The Trip Planner was not designed or intended to be a basis for a detailed walk path assessment.

## RECOMMENDATIONS

Determining the accessibility of a walk path requires extensive field work. A desktop analysis using existing data sources cannot determine the full accessibility of a walk path. In some cases, however, existing data sources can determine the inaccessibility of a walk path. The pedestrian environment is constantly changing as a result of land use changes, streetscape and roadway projects, utility projects, weather and climate, and other external forces. This ever-changing pedestrian environment can quickly render the data sources outdated and unreliable.

In addition, accessibility is different for differing types of riders. Accessibility needs are very individualized depending on age, type of disability, and other changing factors such as the weather. A review of information from secondary sources and datasets can be a useful preliminary step in accessing walk path accessibility. Incorporating actual bus stop locations into the Trip Planner could enhance this preliminary step. The combination of needs being so individualized and the changing environment mean that an accurate assessment of a walk path can only be determined through field assessment.

To further the process of identifying and improving pathways for MetroAccess and MetroBus customers, the following are recommended:

- The cluster analysis can be used to target high use locations on both ends of the trip. This, coupled with customer disability information, could provide a list of priority areas where investments in pedestrian infrastructure and personalized travel training could allow current MetroAccess customers to begin using fixed-route service.

- Incorporate pictometry in Trip Planner or develop an application that would help customers make some evaluations of their paths of travel so they can choose the itineraries that work best for them. Current aerial imagery associated with Trip Planner is inadequate for level of detail needed for a full path assessment.

- Add bus stop inventory data to Trip Planner. This will allow for a more accurate walk path between the bus stop and the trip end to be generated. This will also allow customers to determine the level of accessibility and amenities at the stop.

- Ensure the Trip Planner has the most up-to-date bus schedules from the local jurisdictions.

- Target locations where improvements will have the greatest impact. Locations with grouped trips may not have as much impact on efficiencies as locations where individual trips account for a large number trip activity.

# APPENDIX A

# ANNOTATED DATA DICTIONARY

# APPENDIX A

## Pathway Assessment Annotated Dictionary

1. **Location [Open Text Field]**

   Name or address of the location being assessed.

2. **Segment [Open Numeric Field]**

   The numerical value assigned to the segment for a particular walk path.

3. **Walk Path [Text Drop-Down Option]**

   The path used by pedestrian for access. Options include: Sidewalk, Shoulder, Parking Lot, Intersection, Other, None.

4. **Walk Path Width [Text Drop-Down Option]**

   Narrowest clear width exclusive of the curb. Options include: Greater than 3′, Less than 3′, n/a.

5. **Surface Problem [Text Drop-Down Option]**

   Describes the condition of the walk path. Options include: Uneven Pavement, Metal Grates, Metal Grates, Overgrown Vegetation, Other, Not Applicable.

6. **Walk Path Gap [Text Drop-Down Option]**

   Gap in sidewalk panel parallel to the direction of travel. Options include: Greater than ½″, None, Not Applicable.

7. **Vertical Elevation [Text Drop-Down Option]**

   Vertical abruptions in the level along the walk path parallel to the direction of travel. Options include: Greater than ¼″, None, Not Applicable.

8. **Protrusion [Yes, No, Drop-Down Option]**

   Object protruding over 4 1/2″ into the path of travel. Options include: Yes, No, Not Applicable

9. **Walk Path Slope [Text Drop-Down Option]**

   The slope of the walk path in the direction of travel. Options include: Greater than 5 degrees, Less than 5 degrees, Not Applicable.

10. **Walk Path Cross Slope [Text Drop-Down Option]**

    The slope perpendicular to the direction of travel. Options include: Greater than 2 degrees, Less than 2 degrees, Not Applicable.

11. **Traffic Control [Text Drop-Down Option]**

    Type of traffic control for intersection crossings. Options include: Traffic Light, Stop Sign, Roundabout, Other, None, Not Applicable.

12. **Pedestrian Signal [Text Drop-Down Option]**

    Type of pedestrian signal at the intersection. Options include: User Activated, Automatic, None, Not Applicable.

13. **Pedestrian Signal Access [Yes, No, Drop-Down Option]**

    Minimum of 3′ wide unobstructed paved connection to pedestrian signal. Options include: Yes, No, Not Applicable.

14. **Audible Pedestrian Signal [Yes, No, Drop-Down Option]**

    Options include: Yes, No, Not Applicable

15. **Obstruction [Text Drop-Down Option]**

    An element that either constricts the width of the paved walk path to less than 3′ or completely access. Options include: Utility Pole, Traffic Light Pole, Traffic Sign Pole, Bus Stop Pole, Pedestrian Signal Pole, Newspaper Box, Bus Shelter, Bench, Trash Can, Landscaping, Median, Vehicles, Other, None.

### 16. Curb Ramp Connection [Yes, No, Drop-Down Option]

The availability of one or more curb ramps to allow access off and/or onto the curb. Options include: Yes, No, Not Applicable.

### 17. Number of Curb Ramps [Open Numeric Text Field]

The number of curb ramps present along a particular segment.

### 18. Curb Ramp Problems [Text Drop-Down Option]

Options include: Slope Problem, No Detectable Surface Warning, No 3′x3′ Landing, Missing, None, Not Applicable.

### 19. Crosswalk [Yes, No, Drop-Down Option]

Options: Yes, No, Not Applicable.

### 20. Wheelchair Ramp [Yes, No, Drop-Down Option]

Paved access ramp as an alternative to stairs leading up to the entrance of a building. Options include: Yes, No, Not Applicable.